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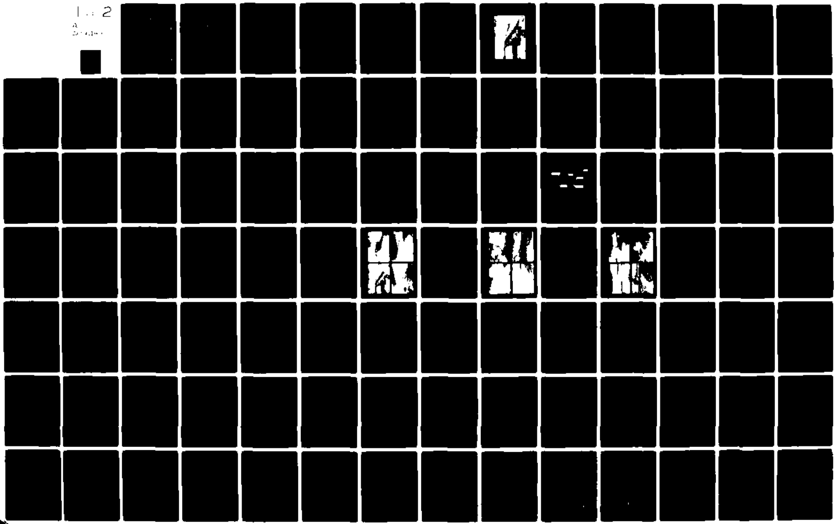

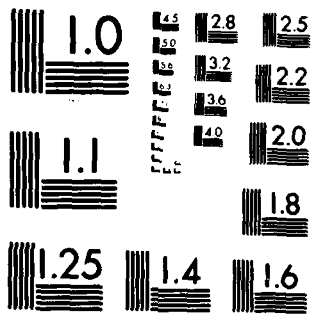

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SPRING RUN, FRANKLIN COUNTY

(6) National Dam Inspection Program.

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COMET LAKE DAM

(NDI I.D. ~~No.~~ Number PA-00796,
PENNDER I.D. ~~No.~~ Number 28-103),
Potomac River Basin,
Spring Run, Franklin County, Pennsylvania.

~~DACW31-80-C-0016~~

PHASE I INSPECTION REPORT,
NATIONAL DAM INSPECTION PROGRAM

(15) DACW31-80-C-0016

(12) 102

(10) Bernard M. Mihalcin

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

PREPARED BY

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(11) AUG ~~1980~~

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of ~~a Phase I~~ this investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topograhic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase ~~I~~ investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Comet Lake Dam: NDI I.D. No. PA-00796

<u>Owner</u>: Wohelo Realty Company

<u>State Located</u>: Pennsylvania (PennDER I.D. No. 28-103)

<u>County Located</u>: Franklin

<u>Stream</u>: Spring Run

<u>Inspection Date</u>: 26 June 1980

<u>Inspection Team</u>: GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on a visual inspection, operational history, and hydrologic/hydraulic analysis, the dam is considered to be in fair condition.

The size classification of the facility is small and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility ranges between the 1/2-PMF (Probable Maximum Flood) and the PMF. Due to the high potential for damage to downstream structures and possible loss of life that could be associated with a sudden breach of the embankment, the SDF is considered to be the PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store only about 44 percent of the PMF prior to embankment overtopping. A breach analysis indicates that failure under less than 1/2-PMF conditions would likely not lead to increased downstream damage or loss of life. Thus, based on the screening criteria contained in the recommended guidelines, the spillway is considered to be inadequate, but not seriously inadequate. If the embankment crest was regraded to its original design elevation, the facility would pass and/or store approximately 73 percent of the PMF prior to embankment overtopping, but would still be considered inadequate.

It is recommended that the owner immediately:

a. Regrade the embankment crest to its original design elevation under the direction of a registered professional engineer experienced in the design and construction of earth dams, or, retain the services of a registered professional engineer experienced in the hydraulics and hydrology of dams to further assess the adequacy of the emergency spillway and take remedial measures deemed necessary to make the facility hydraulically adequate.

b. Develop a formal emergency warning system to notify downstream residents should hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

c. Reshape the emergency spillway channel to provide sufficient sidewall height to ensure the safe discharge of flow away from the embankment.

d. Remove the trash and debris currently piled in the emergency spillway approach channel and restrict the area from such future use.

e. Provide positive drainage for the two swampy areas located immediately downstream of the embankment. Flow collected from the area adjacent the right abutment may be significant and should be assessed in all future inspections noting any turbidity and/or changes in rate of flow.

f. Clear the embankment slopes and emergency spillway of all excess vegetation.

g. Replace the corroded metal grate atop the service spillway riser with a suitable trash rack.

h. Develop formal manuals of operation and maintenance to ensure the future proper care of the facility.

GAI Consultants, Inc.

Bernard M. Mihalcin, P.E.

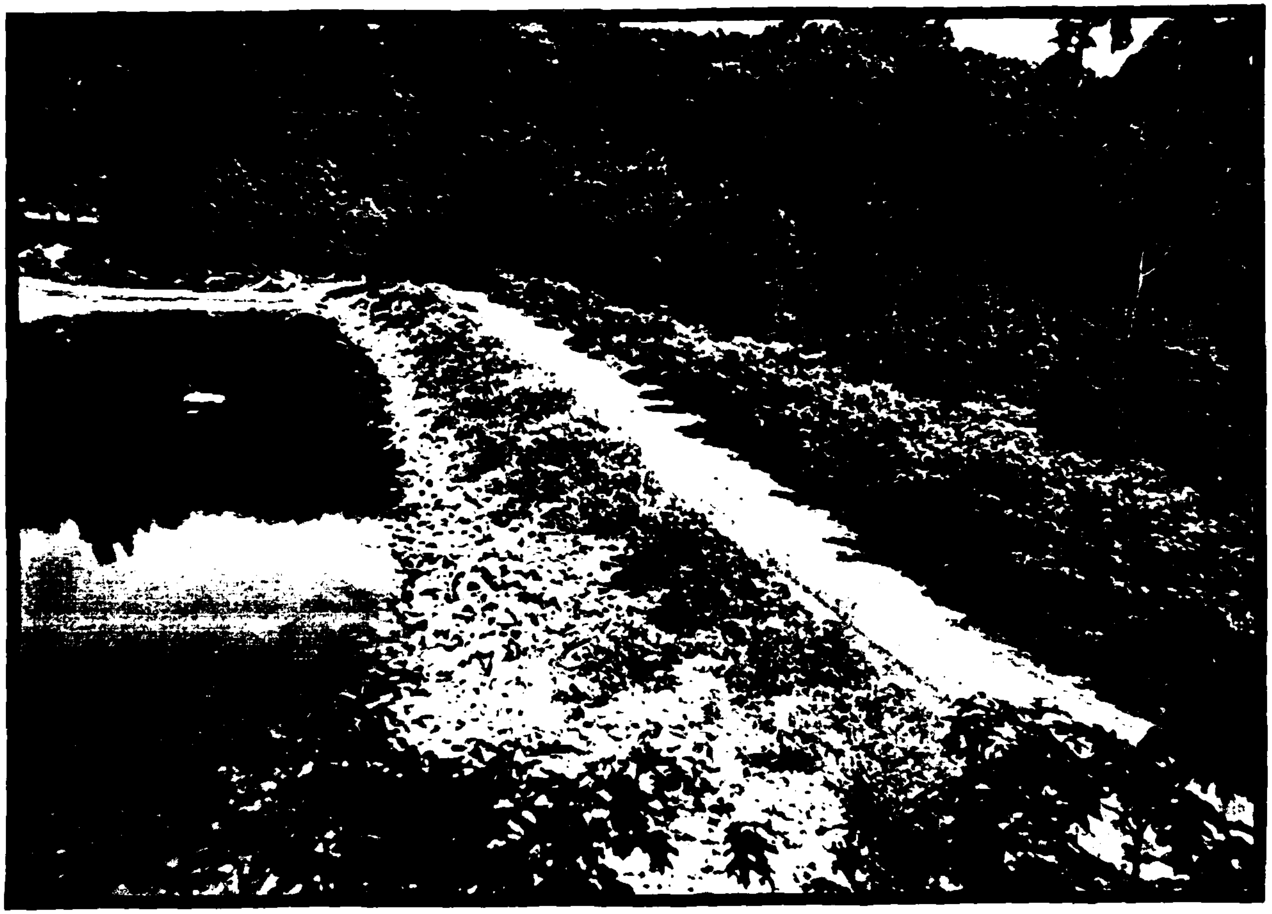
COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
BERNARD M. MIHALCIN
ENGINEER
20371-E

Date 25 August 80

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date 12 Sep 80



OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
COMET LAKE DAM
NDI #PA-00796, PENNDER #28-103

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Comet Lake Dam is a zoned earth embankment approximately 38 feet high and 341 feet long, including spillway. The facility is provided with an uncontrolled, trapezoidal shaped emergency spillway, cut into rock, at the left abutment. Discharge is dictated by critical depth at the control section with no regulating weir. Drawdown capability is provided by means of a 12-inch diameter cast iron pipe (CIP) controlled by a 12-inch diameter gate valve located within a small concrete riser situated along the upstream embankment face. The riser also serves as a drop inlet type service spillway.

b. Location. Comet Lake Dam is located on Spring Run in Washington Township, Franklin County, Pennsylvania about four miles southeast of Waynesboro, Pennsylvania. The facility is part of Camp Comet, a summer recreational camp. The dam and reservoir are contained within the Smithsburg, Maryland-Pennsylvania U.S.G.S. 7.5 minute topographic quadrangle (see Figure 1, Appendix E). The coordinates of the dam are N39° 44.2' and W77° 30.4'.

c. Size Classification. Small (38 feet high, 62 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Wohelo Realty Comapny
12811 Old Route 16
Waynesboro, Pennsylvania 17268
Attn: Morgan I. Levy

f. Purpose. Recreation and fire protection.

g. Historical Data. Comet Lake Dam was designed by John F. McClellan of Waynesboro, Pennsylvania and constructed by John F. Walters of Newville, Pennsylvania in 1961 and 1962. PennDER files indicate that the entire embankment was constructed prior to their notification; however, the owner purported that the designer was present during the embankment construction and that the work was performed in accordance with the plans.

The spillway construction was the subject of much discussion as the final details deviated significantly from the plans. As-built drawings were finally requested by the state and a detail of the spillway was prepared.

No records of major modifications since construction are available although the field inspection revealed that the outlet end of the service spillway and blowoff pipe does not exist as per design.

1.3 Pertinent Data.

a. Drainage Area (square miles). 0.29

b. Discharge at Dam Site.

Discharge Capacity of Outlet Conduit - Discharge curves are not available.

Discharge Capacity of Emergency Spillway at Maximum Pool ≅ 470 cfs (see Appendix D, Sheet 11).

c. Elevation (feet above mean sea level). The following elevations were obtained from design drawings and field measurements based on the elevation of the top of the service spillway-control tower riser (see Appendix D, Sheet 1).

Top of Dam	974.0 (design). 972.8 (field).
Maximum Design Pool	972.0
Maximum Pool of Record	Not known.
Normal Pool	968.0

Top of Riser	968.0
Service Spillway Crest	968.0
Emergency Spillway Crest	970.0 (design). 968.8 (field).
Upstream Inlet Invert	945.0
Downstream Outlet Invert	926.0 (design).
Downstream Embankment Toe	934.5
Streambed at Dam Centerline	935.0
Maximum Tailwater	Not known.

d. <u>Reservoir Length (feet)</u>.

Top of Dam	700
Normal Pool	600

e. <u>Storage (acre-feet)</u>.

Top of Dam	62
Maximum Design Pool	59
Normal Pool	45
Design Surcharge	3

f. <u>Reservoir Surface (acres)</u>.

Top of Dam	4
Normal Pool	3

g. <u>Dam</u>.

Type	Zoned earth.
Length	295 feet (excluding spillway).
Height	38 feet (field measured; embankment crest to base of downstream embankment toe).
Top Width	12 feet (design). 19 feet (field).
Upstream Slope	2.5H:1V (design). 1.5H:1V (field).
Downstream Slope	2H:1V (design). 1.75H:1V (field).
Zoning	Impervious core and cutoff trench flanked

	by semi-pervious outer shells comprised of a soil/clay-shale mixture (see Figure 3).
Impervious Core	Core section with 24-foot bottom width extending to within two feet of the embankment crest (see Figure 3).
Cutoff	8-foot wide cutoff trench along embankment centerline reportedly extends six feet into bedrock (see Figure 3).
Grout Curtain	None indicated.

h. <u>Diversion Canal and Regulating Tunnels</u>. None.

i. <u>Service Spillway</u>.

Type	Small, drop inlet type concrete riser with a 12-inch diameter concrete encased, corrugated metal discharge conduit (see Figures 3 and 4).
Crest Elevation	968.0 feet.

j. <u>Emergency Spillway</u>.

Type	Uncontrolled, trapezoidal shaped, rock cut channel with no regulating weir.
Crest Elevation at Control	968.8 feet.
Base Width at Control	9 feet.
Top Width at Control	35 feet.

k. Outlet Conduit.

Type	12-inch diameter concrete encased, corrugated metal pipe.
Length	260 feet.
Closure and Regulating Facilities	Flow through the outlet is controlled via 12-inch diameter gate valve located at the base of the riser (see Figure 4).
Access	Valve control mechanism accessible only by boat.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. No design reports, calculations, or formal design data are available. Three design drawings and one as-built spillway plan are contained in PennDER files along with miscellaneous correspondence.

b. Design Features.

1. Embankment. Information contained in PennDER files indicates the embankment is a zoned earth structure constructed with an impervious central core and semi-impervious outer shells. Figure 3 indicates the structure is provided with a cutoff trench along the embankment centerline that extends six feet into bedrock. The design slopes were set at 2H:1V and 2.5H:1V for the downstream and upstream slopes; however, field measurements reveal these slopes to be closer to 1.75H:1V and 1.5H:1V, respectively. The embankment crest has been covered with a bituminous surface.

2. Appurtenant Structures.

a) Service Spillway. The service spillway consists of a small, drop inlet type, vertical concrete riser located along the upstream embankment slope. Flow from the riser is discharged via a 12-inch diameter, concrete encased, corrugated metal pipe (see Figures 2, 3 and 4). The outlet end has apparently been extended and discharges at a location approximately 70 feet beyond the downstream embankment toe.

b) Emergency Spillway. The emergency spillway is an uncontrolled, trapezoidal shaped, rock cut channel located at the left abutment. Discharge is dictated by critical depth at the control section with no regulating weir (see Figure 5). The original design drawings required a concrete control section that was never constructed (see Figure 4). The spillway section downstream of the control is poorly defined with a right sidewall locally less than 1-foot high. This may be attributable to the fact that the emergency spillway also functions as a service road to the lower toe area and that some regrading may have been done within the channel to accommodate vehicular use.

c) Outlet Conduit. The outlet conduit is a 12-inch diameter concrete encased, corrugated metal pipe

with inlet at the upstream embankment toe and discharge outlet at the base of the concrete riser. Flow is conveyed beyond the downstream embankment toe by a 12-inch diameter CMP that also functions as the service spillway discharge conduit. Control is provided by a 12-inch diameter gate valve apparently mounted on the inside face of the riser (Figure 4 incorrectly shows the gate valve on the outside of the riser.) Since the gate is operated from atop the riser, the structure is referred to as a service spillway-control tower riser. Flow from the outlet conduit is discharged into the riser and exits through the service spillway conduit (see Figures 2, 3 and 4).

c. Specific Design Data and Criteria. No formal design data or information relative to design procedures are available.

2.2 Construction Records.

No construction records are available.

2.3 Operational Records.

No records of the present day-to-day operation of the facility are maintained.

2.4 Other Investigations.

Except for a single state inspection report dated 1970, no records of other investigations are available.

2.5 Evaluation.

The available data in conjunction with the visual inspection are considered adequate to make a reasonable Phase I evaluation of the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the facility indicates the dam and its appurtenances are currently in fair condition.

b. Embankment. Observations made during the visual inspection indicate the embankment is in fair condition. No evidence of sloughing, erosion, seepage through the embankment face, or animal burrows were observed. The embankment slopes are heavily overgrown with thick brush indicating a lack of regular, routine maintenance (see Photographs 1, 3 and 4). Two distinct swampy areas were observed as indicated on the field sketch (see "General Plan, Field Inspection Notes", Appendix A). Both swampy areas are located beyond the limits of the downstream embankment toe (see Photograph 8). No measurable seepage flow was observed. The embankment crest is well protected with a cover of asphalt paving; however, field measurements indicate differential settlements in excess of 1-foot (see "Profile of Dam Crest", Appendix A).

c. Appurtenant Structures

1. Service Spillway. The visual inspection revealed the service spillway is in fair condition. The riser exhibits general concrete deterioration in the form of spalling and scaling. The metal grate atop the drop inlet is thoroughly corroded and practically non-functional in its present condition (see Photographs 9 and 10).

2. Emergency Spillway. The emergency spillway is in fair condition. The channel is overgrown and poorly defined (see Photograph 6). The right sidewall is generally less than 1-foot high and may not adequately protect the downstream embankment toe from being inundated by large spillway discharges. On the day of the inspection, a large pile of trash and debris was observed in the spillway approach area (presumably being removed), indicating a lack of previous concern for keeping the spillway free of potential obstructions (see Photograph 5).

3. Outlet Conduit. The outlet conduit was totally submerged and not observed by the inspection team. Although not specifically operated in the presence of the inspection team, the conduit was discharging during the inspection. The owner stated that the valve was recently opened slightly in order to draw the reservoir down several feet so that repairs could be performed at the boathouse.

d. Reservoir Area. The general area surrounding the reservoir is composed of steep, partially wooded slopes. No signs of slope distress were observed (see Photographs 9 and 10).

e. Downstream Channel. Discharge from Comet Lake Dam flows through a steep, narrow and heavily forested valley westward out of the Blue Ridge Mountains and into the floodplain just east of Waynesboro, Pennsylvania. Between the toe of Mount Dunlop (see Figure 1, Appendix E) and the western edge of the village of Rouzerville, Pennsylvania, about one to two miles downstream of the embankment, at least a dozen homes and small businesses are situated sufficiently near the stream to possibly be affected by an embankment breach. It is estimated that more than a few lives could be lost and substantial economic damage incurred as a result of such an event. It is noted that many more persons could be affected who live within the Red Run floodplain beyond Rouzerville and along the banks of the east branch of Antietam Creek. Consequently, the hazard classification is considered to be high.

3.2 Evaluation.

The overall condition of the facility is considered to be fair. Deficiencies requiring remedial attention include: 1) providing positive drainage for the two swampy areas located beyond the downstream embankment toe; 2) regrading the embankment crest to its design elevation; 3) clearing the embankment slopes and emergency spillway of all excess vegetation; 4) reshaping of the emergency spillway channel to prevent against large discharges inundating the downstream embankment toe; 5) removing the trash currently piled in the emergency spillway approach channel and restricting the future use of this area for such purposes; and 6) replacing the metal grate atop the service spillway riser with a suitable trash rack.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

The facility is essentially self-regulating. Excess inflow passes through the service spillway and is discharged beyond the downstream embankment toe. Inflows in excess of the capacity of the service spillway are stored and/or discharged through the emergency spillway. Under normal operating conditions the blowoff conduit is closed. No formal operations manual is available.

4.2 Maintenance of Dam.

The condition of the facility as observed by the inspection team is indicative of a general lack of routine maintenance. The owner has sufficient staff to perform needed maintenance on a regularly scheduled basis; however, no formal maintenance manual is available that defines routine maintenance or provides a schedule for its regular performance.

4.3 Maintenance of Operating Facilities.

See Section 4.2 above.

4.4 Warning System.

No formal warning system is presently in effect. The owner has established a radio communications system between Camps Comet and Wohelo which was reportedly utilized during the last major flood in June 1972. The system effectively maintained contact with observers stationed at the dam and with police and local authorities in downstream communities.

4.5 Evaluation.

No formal operations or maintenance manuals are available for the facility, but, are recommended to ensure the proper care and operation of the facility. In addition warning system procedures should be formalized and incorporated into these manuals.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No formal design data, calculations, or design reports are available.

5.2 Experience Data.

Daily records of reservoir levels and/or spillway discharges are not available. The owner recalled that the largest flood experienced at the facility occurred in June 1972. The reservoir level was not recorded; however, this reportedly was the only time in the relatively brief history of this facility that the emergency spillway discharged. No significant damage was incurred.

5.3 Visual Observations.

Visual observations indicate the spillway is inadequately maintained and poorly defined. Overgrowth along the channel and debris piled in the approach are potential obstructions to free discharge. The right channel sidewall downstream of the control was observed to be less than 1-foot high locally. This may be insufficient to retain flow within the channel and, thus, away from the embankment.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U.S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway Design Flood (SDF) for Comet Lake Dam

ranges between the 1/2-PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (small), and the potential hazard of dam failure to downstream developments (high). Due to the high potential for damage to downstream structures and possibly loss of life, the SDF for this facility is considered to be the PMF.

b. Results of Analysis. Comet Lake Dam was evaluated under near normal operating conditions. That is, the reservoir was initially at its normal pool or service spillway elevation of 968.0, with the low level blowoff line assumed to be closed. The usually functioning service spillway, which consists of a rectangular concrete riser and a 12-inch diameter cast iron outlet pipe, was assumed to be non-functional for the purpose of analysis. In any event, the flow capacity of the riser and outlet pipe is not such that it would significantly increase the total discharge capabilities of the dam and reservoir. The emergency spillway consists of a trapezoidal shaped channel cut in rock, with discharges dictated by critical depth at the control section. All pertinent engineering calculations relevant to the evaluation of this facility are provided in Appendix D.

Overtopping analysis (using the Modified HEC-1 Computer Program) indicated that the discharge/storage capacity of Comet Lake Dam can accommodate only about 44 percent of the PMF (SDF) prior to embankment overtopping. Under PMF conditions, the low top of dam was inundated for about 3.7 hours by depths of up to 1.2 feet. Under 1/2-PMF conditions, the dam was inundated for about one hour, with a maximum depth of 0.3 feet above the low top of dam (Appendix D, Summary Input/Output Sheets, Sheet F). Since the SDF for Comet Lake Dam is the PMF, it can be concluded that the dam has a high potential for overtopping, and thus, for breaching under floods of less than SDF magnitude.

As Comet Lake Dam cannot safely accommodate a flood of at least 1/2-PMF magnitude, the possibility of dam failure under floods of less than 1/2-PMF intensity was investigated (in accordance with Corps directive ETL-1110-2-234). Several possible alternatives were examined, since it is difficult, if not impossible, to determine exactly how or if a specific dam will fail. The major concern of the breaching analysis is with the impact of the various breach discharges on increasing downstream water surface elevations above those to be expected if breaching did not occur.

The Modified HEC-1 Computer Program was used for the breaching analysis, with the assumption that the breaching of an earth dam would begin once the reservoir level reached

the low top of dam elevation. Also, in routing the outflows downstream, the channel bed was assumed to be initially dry.

Five breach models were analyzed for Comet Lake Dam. First, two sets of breach geometry were evaluated for each of two failure times. The two sets of breach sections chosen were considered to be the maximum and minimum probable failure sections. The two failure times (total time for each breach section to reach its final dimensions) under which the two breach sections were investigated were assumed to be a rapid time (0.5 hours) and a prolonged time (4.0 hours), so that a range of this most sensitive variable might be examined. In addition, an average possible set of breach conditions was analyzed, with a failure time of 2.0 hours (Appendix D, Sheet 16).

The peak breach outflows (resulting from 0.45 PMF conditions) ranged from about 490 cfs for the minimum section-maximum fail time scheme to about 2710 cfs for the maximum section-minimum fail time scheme (Appendix D, Sheet 18). The peak outflow resulting from the average breach scheme was about 1570 cfs, compared to the non-breach 0.45 PMF peak outflow of about 490 cfs (Summary Input/Output Sheets, Sheets L and F).

Two potential centers of damage were investigated in the analysis. At Section 3 (see Figure 1), located about 1.0 mile downstream from the dam, all breach outflows remained well below the damage level of the nearby residence. The second potential damage center is located at Section 4 (see Figure 1), about 1.7 miles downstream from Comet Lake Dam. At this section, all breach outflows remained within the channel banks, and thus, below the damage elevations of the nearby homes (Appendix D, Sheet 19). From this analysis, it is concluded that the failure of Comet Lake Dam would not likely lead to increased property damage or loss of life in the downstream regions, as they exist at present.

5.6 Spillway Adequacy.

As presented previously, under existing conditions, Comet Lake Dam can accommodate only about 44 percent of the PMF prior to embankment overtopping. Should a 0.45 PMF event or larger occur, the dam would be overtopped, and could possibly fail. Since the failure of this dam would probably not lead to increased property damage or loss of life at existing residences, its spillway is considered inadequate, but not seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Observations made during the visual inspection indicate the embankment is currently in fair condition. Lack of adequate maintenance has resulted in overgrown slopes and a generally poor appearance; nevertheless, no evidence of excess embankment stresses, slope instability, or seepage through the downstream embankment face was observed. Heavy overgrowth across the embankment slopes and along the downstream toe hamper visual observation of critical conditions and should be removed. Field measurements indicate differential settlement across the embankment crest in excess of 1-foot. Large settlements such as this effectively reduce the available freeboard and spillway capacity. Moreover, in the event the embankment should be overtopped, they create channels that concentrate flows and induce breaching. Consequently, it is recommended the embankment crest be regraded to its design elevation.

b. Appurtenant Structures.

1. Service Spillway. The service spillway appears structurally sound and is presently in fair condition. Observed concrete deterioration is considered minor at present, but, should be reassessed in all future inspections. The grate atop the riser is thoroughly corroded and should be replaced.

2. Emergency Spillway. The emergency spillway has been subjected to the same general lack of maintenance apparent for the embankment. Overgrowth along the channel and debris piled in the approach are potential obstructions to free discharge. The channel is also poorly defined with a small right sidewall which may not be adequate to retain flow within the channel and away from the embankment.

3. Outlet Conduit. The outlet conduit is operable and in apparently good condition.

6.2 Design and Construction Techniques.

No information is available that details the methods of

design and/or construction.

6.3 Past Performance.

Since completion in 1961, the facility has reportedly performed adequately. The largest flood experienced at the facility reportedly occurred in June 1972 at which time, the emergency spillway discharged. No significant damage was incurred.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and may be subject to minor earthquake induced dynamic forces. As the facility appears well constructed and sufficiently stable, it is believed it can withstand the expected dynamic forces; however, no calculations and/or investigations were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The results of this evaluation indicate the facility is in fair condition.

The size classification of the facility is small and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for the facility ranges between the 1/2-PMF (Probable Maximum Flood) and the PMF. Due to the high potential for damage to downstream structures and possible loss of life that could be associated with a sudden breach of the embankment, the SDF is considered to be the PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store only about 44 percent of the PMF prior to embankment overtopping. A breach analysis indicates that failure under less than 1/2-PMF conditions would likely not lead to increased downstream damage or loss of life. Thus, based on the screening criteria contained in the recommended guidelines, the spillway is considered to be inadequate, but not seriously inadequate. If the embankment crest was regraded to its original design elevation, the facility would pass and/or store approximately 73 percent of the PMF prior to overtopping, but would still be considered inadequate.

b. Adequacy of Information. The available data are considered sufficient to make a reasonable Phase I assessment of the facility.

c. Urgency. The following recommendations should be implemented immediately.

d. Necessity for Additional Investigations. Additional hydrologic/hydraulic investigations are considered necessary to more accurately assess the adequacy spillway system, and to determine if large discharges will affect or inundate the toe of the embankment.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner immediately:

a. Regrade the embankment crest to its original design elevation under the direction of a registered professional engineer experienced in the design and con-

struction of earth dams, or, retain the services of a registered professional engineer experienced in the hydraulics and hydrology of dams to further assess the adequacy of the emergency spillway and take remedial measures deemed necessary to make the facility hydraulically adequate.

b. Develop a formal emergency warning system to notify downstream residents should hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

c. Reshape the emergency spillway channel to provide sufficient sidewall height to ensure the safe discharge of flow away from the embankment.

d. Remove the trash and debris currently piled in the emergency spillway approach channel and restrict the area from such future use.

e. Provide positive drainage for the two swampy areas located immediately downstream of the embankment. Flow collected from the area adjacent the right abutment may be significant and should be assessed in all future inspections noting any turbidity and/or changes in rate of flow.

f. Clear the embankment slopes and emergency spillway of all excess vegetation.

g. Replace the corroded metal grate atop the service spillway riser with a suitable trash rack.

h. Develop formal manuals of operation and maintenance to ensure the future proper care of the facility.

APPENDIX A

VISUAL INSPECTION CHECKLIST AND FIELD SKETCHES

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Comet Lake Dam **STATE** Pennsylvania **COUNTY** Franklin

NDI # PA — 00796 **PENNDER #** 28-103

TYPE OF DAM Earth **SIZE** Small **HAZARD CATEGORY** High

DATE(S) INSPECTION 26 June 1980 **WEATHER** Sunny **TEMPERATURE** 85° @ 1:00 PM

POOL ELEVATION AT TIME OF INSPECTION 967.2 **M.S.L.**

TAILWATER AT TIME OF INSPECTION - **M.S.L.**

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	*OTHERS*
B. M. Mihalcin	Morgan Levy	T. M. Majusiak (FEMA)
D. J. Spaeder		
D. L. Bonk		

RECORDED BY B. M. Mihalcin

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00796
SURFACE CRACKS	None observed. Downstream slope heavily overgrown with briars, locust trees and miscellaneous vegetation.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good. Vertical - see "Profile of Dam Crest," Appendix A.
RIPRAP FAILURES	None observed. Riprap is durable, hard, well graded sandstone that extends to the crest.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00796
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	Two areas (see "General Plan-Field Inspection Notes," Appendix A). 1. Area several feet to the right of the emergency spillway. 2. Area immediately downstream of toe along right abutment (≈ 30 feet wide).
ANY NOTICEABLE SEEPAGE	None through face of dam; however, both areas listed above are saturated and exhibit noticeable seepage.
STAFF GAGE AND RECORDER	None.
DRAINS	None observed.

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00796
INTAKE STRUCTURE	Vertical, concrete control tower riser located along the upstream embankment slope about 20 feet into the reservoir. Evidence of concrete deterioration observed. Protective grating atop riser is loose and dilapidated. Riser also functions as a drop inlet service spillway.
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	12-inch diameter concrete encased, corrugated metal pipe.
OUTLET STRUCTURE	None.
OUTLET CHANNEL	Small ditch to stream channel.
GATE(S) AND OPERATIONAL EQUIPMENT	12-inch diameter gate valve inside riser. Operated by stem from atop riser. Wheel in utility building. Gate partially open at time of inspection.

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00796
TYPE AND CONDITION	Uncontrolled, trapezoidal shaped channel with no regulating weir. Channel is poorly designed with virtually no sidewall between the channel and dam to protect the embankment toe from being inundated. Channel is partially overgrown.
APPROACH CHANNEL	Large entrance channel partially covered with bituminous paving. Trash has been piled in the middle of the channel and presumably will be removed.
SPILLWAY CHANNEL AND SIDEWALLS	Grass lined channel reportedly cut in rock along the left abutment. Also functions as a service road to the lower toe area. Sidewall between channel and dam is very small and may not contain spillway flows. Small v-ditch eroded in rock along left side of spillway. Design is questionable.
STILLING BASIN PLUNGE POOL	None.
DISCHARGE CHANNEL	Natural stream.
BRIDGE AND PIERS EMERGENCY GATES	None.

SERVICE SPILLWAY

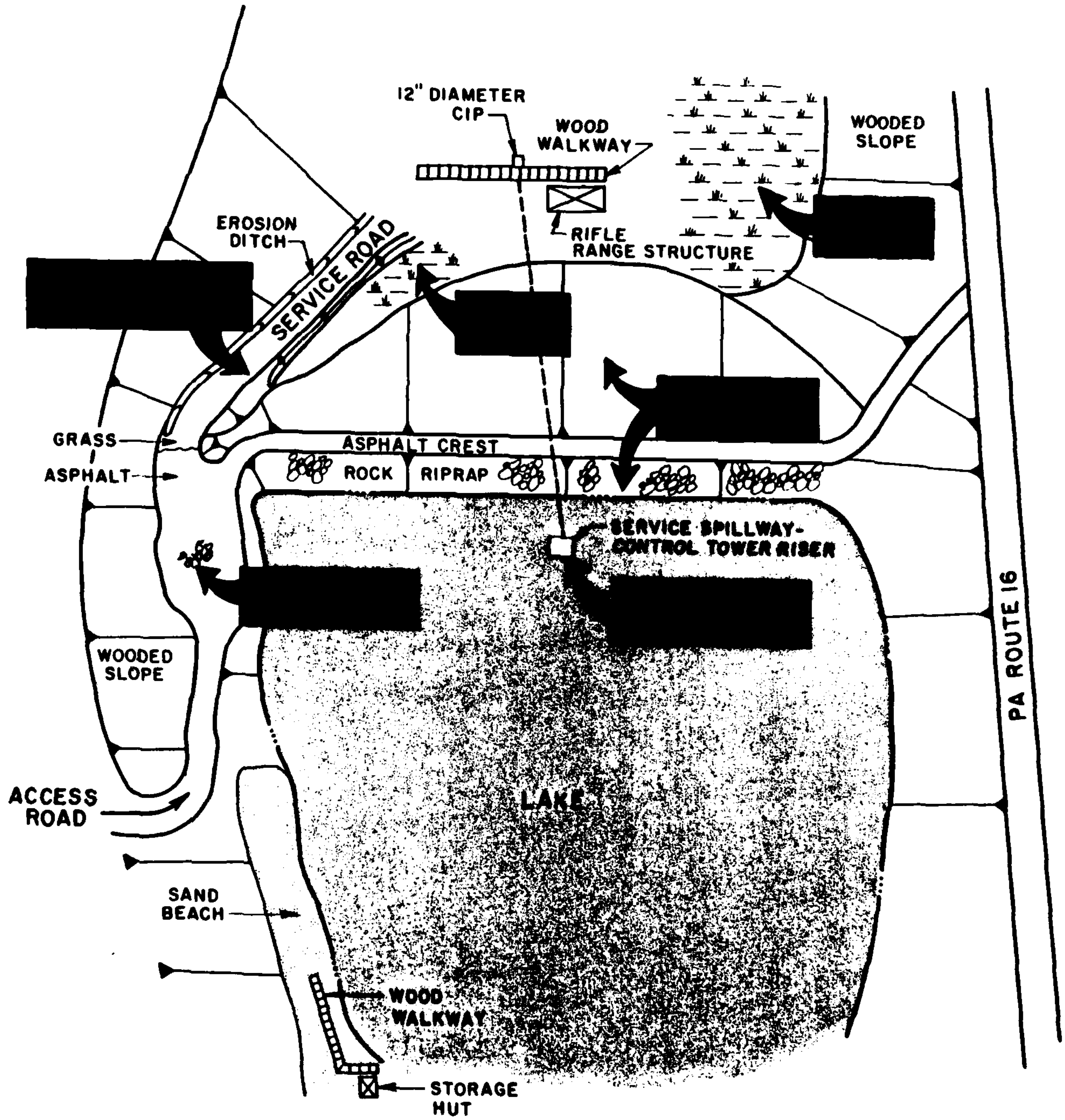
ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00796
TYPE AND CONDITION	Small, rectangular, vertical concrete riser in fair condition. Concrete spalling and scaling evident. Grate atop riser is loose and highly corroded. Should replace grate with adequate trash rack. Vandalism could cause serious problem if outlet is clogged.
APPROACH CHANNEL	N/A.
OUTLET STRUCTURE	12-inch diameter concrete encased, corrugated metal pipe.
DISCHARGE CHANNEL	Small ditch to natural stream.

INSTRUMENTATION

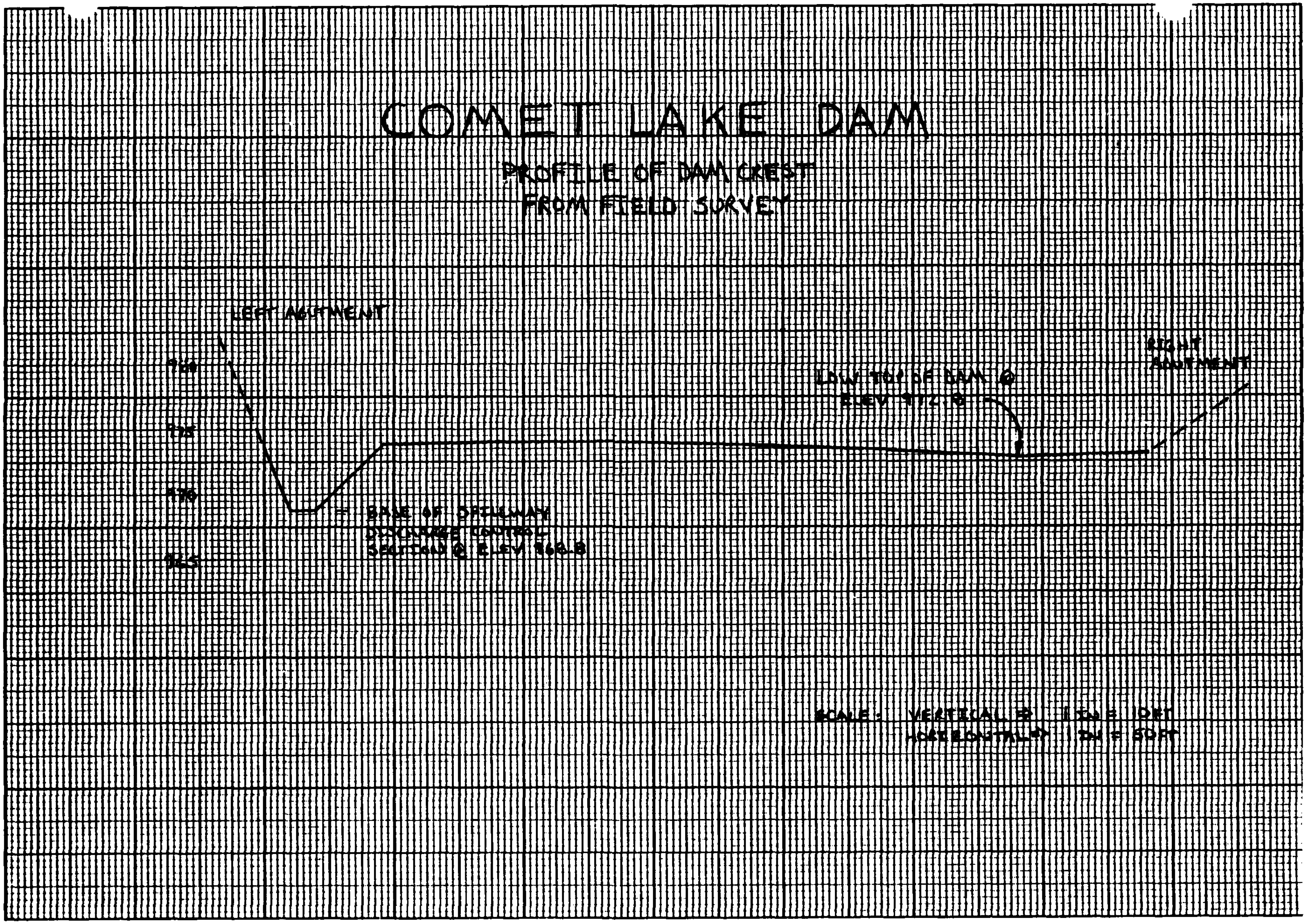
ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00796
MONUMENTATION SURVEYS	None.
OBSERVATION WELLS	None.
WEIRS	None.
PIEZOMETERS	None.
OTHERS	

RESERVOIR AREA AND DOWNSTREAM CHANNEL

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA. 00796
SLOPES: RESERVOIR	Steep and partially wooded.
SEDIMENTATION	None observed.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Natural channel with no apparent obstructions until it passes beneath Pennsylvania Route 16 about 1-mile downstream of the dam.
SLOPES: CHANNEL VALLEY	Steep channel with steep and heavily forested confining slopes from the dam to the toe of the mountain located 1-mile downstream. The channel then flows into a broad floodplain and eventually joins the east branch of Antietam Creek about four miles downstream of the dam.
APPROXIMATE NUMBER OF HQMES AND POPULATION	At least a dozen homes and small businesses are located near the stream in the floodplain between 1 and 2 miles downstream of the dam.



COMET LAKE DAM
GENERAL PLAN - FIELD INSPECTION NOTES


COMET LAKE DAM
PROFILE OF DAM CREST
FROM FIELD SURVEY
LEFT ABUTMENT
RIGHT ABUTMENT
980
975
970
965
LOW TOP OF DAM @
ELEV 972.8
BASE OF SPILLWAY
DISCHARGE CONTROL
SECTION @ ELEV 968.8
SCALE: VERTICAL ⇒ 1 IN = 10FT
HORIZONTAL ⇒ 1 IN = 50FT

APPENDIX B

ENGINEERING DATA CHECKLIST

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM Comet Lake Dam

ITEM	REMARKS NDI# PA- 00796
PERSONS INTERVIEWED AND TITLE	Morgan Levy - owner (partner). Ownership is registered to Wohelo Realty Company 12811 Old Route 16 Waynesboro, PA 17268
REGIONAL VICINITY MAP	See Figure 1, Appendix E.
CONSTRUCTION HISTORY	Constructed in 1961-1962 by John F. Walters of Newville, Pennsylvania. Designed by John F. McClellan of Waynesboro, Pennsylvania.
AVAILABLE DRAWINGS	Five (5) drawings available from PennDER files four of which are included in this report. See Figure 2, 3, 4 and 5, Appendix E. None available from owner.
TYPICAL DAM SECTIONS	See Figure 3, Appendix E.
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figures 2, 3 and 4, Appendix E. Discharge rating curves are not available.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA- 00796
SPILLWAY: PLAN SECTION DETAILS	See Figures 2 and 5, Appendix E.
OPERATING EQUIP-MENT PLANS AND DETAILS	See Figure 4, Appendix E.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None.
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	None.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

NDI# PA - 00796

ITEM	REMARKS
BORROW SOURCES	Not known.
POST CONSTRUCTION DAM SURVEYS	See Figure 5, Appendix E.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
HIGH POOL RECORDS	Formal records of reservoir levels and/or spillway discharges are not available. The highest pool to date reportedly occurred in June 1972. The pool level at that time was not recorded; however, the emergency spillway reportedly did discharge.
MONITORING SYSTEMS	None.
MODIFICATIONS	None.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA- 00796
PRIOR ACCIDENTS OR FAILURES	None.
MAINTENANCE: RECORDS MANUAL	None.
OPERATION: RECORDS MANUAL	None.
OPERATIONAL PROCEDURES	Self-regulating.
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	Radio communication system between Camps Comet and Wohelo is established.
MISCELLANEOUS	

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CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-00796
PENNDER ID # 28-103

SIZE OF DRAINAGE AREA: 0.29 square miles.

ELEVATION TOP NORMAL POOL: 968.0 STORAGE CAPACITY: 45 acre-feet.

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: 972.0 STORAGE CAPACITY: 59 acre-feet.

ELEVATION TOP DAM: 972.8 STORAGE CAPACITY: 62 acre-feet.

SPILLWAY DATA

CREST ELEVATION: 968.0 (service); 968.8 (emergency).

TYPE: Drop inlet (service); rock-cut channel (emergency).

CREST LENGTH: See Section 1.3.j.

CHANNEL LENGTH: N/A (service); ≈ 250 feet (emergency).

SPILLOVER LOCATION: Upstream slope (service); left abutment (emergency).

NUMBER AND TYPE OF GATES: None.

OUTLET WORKS

TYPE: 12-inch diameter concrete encased, corrugated metal pipe.

LOCATION: Left of embankment center.

ENTRANCE INVERTS: 945.0 feet.

EXIT INVERTS: 926.0 feet.

EMERGENCY DRAWDOWN FACILITIES: 12-inch diameter gate valve at base of riser.

HYDROMETEOROLOGICAL GAGES

TYPE: None.

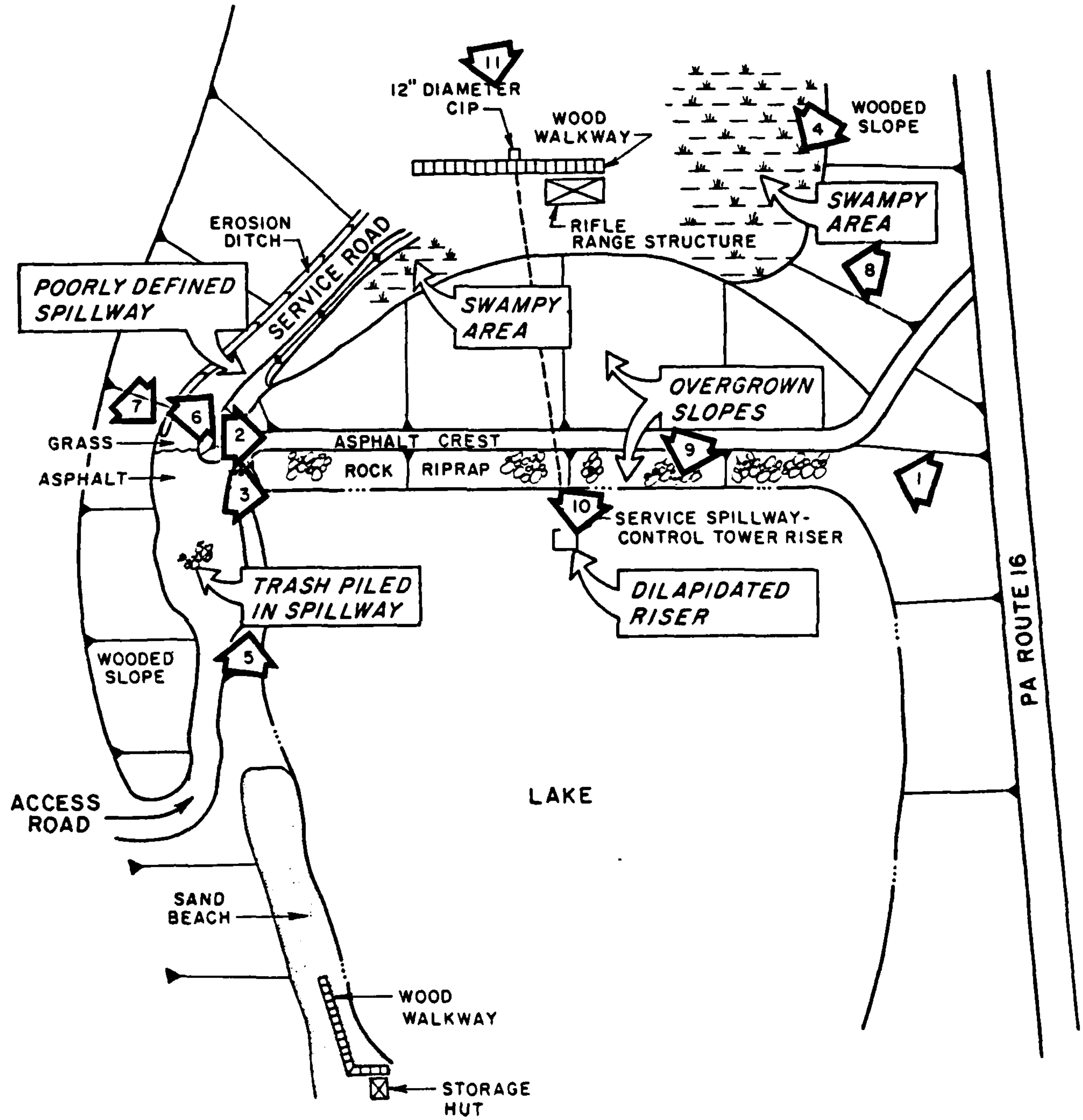
LOCATION: -

RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: Emergency spillway discharged in June 1972.

APPENDIX C

PHOTOGRAPHS



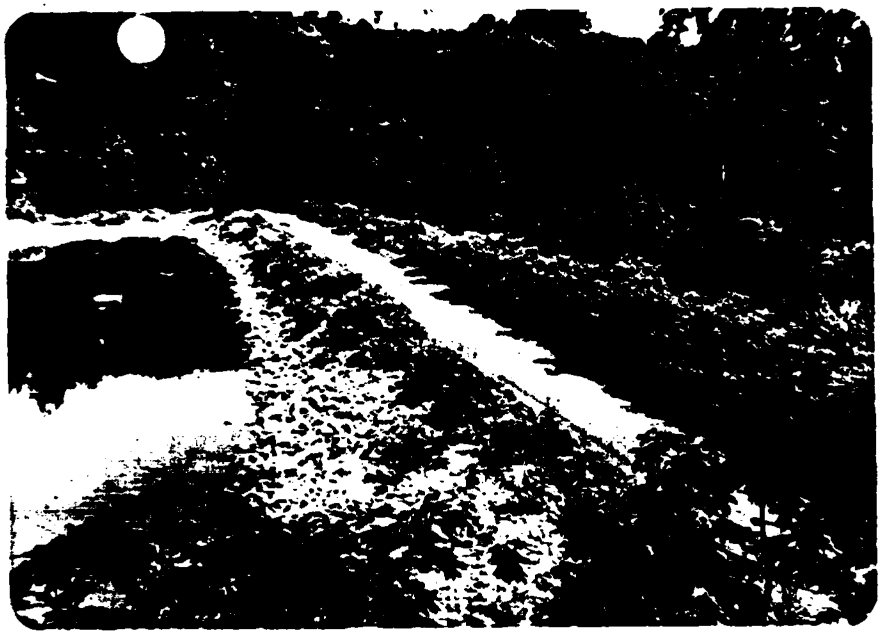
COMET LAKE DAM
PHOTOGRAPH KEY MAP

PHOTOGRAPH 1 Overview of the crest and upstream slope as seen from the right abutment.

PHOTOGRAPH 2 View across the embankment crest looking toward the right abutment.

PHOTOGRAPH 3 View of the upstream embankment face looking toward the right abutment.

PHOTOGRAPH 4 View of the overgrown downstream embankment slope.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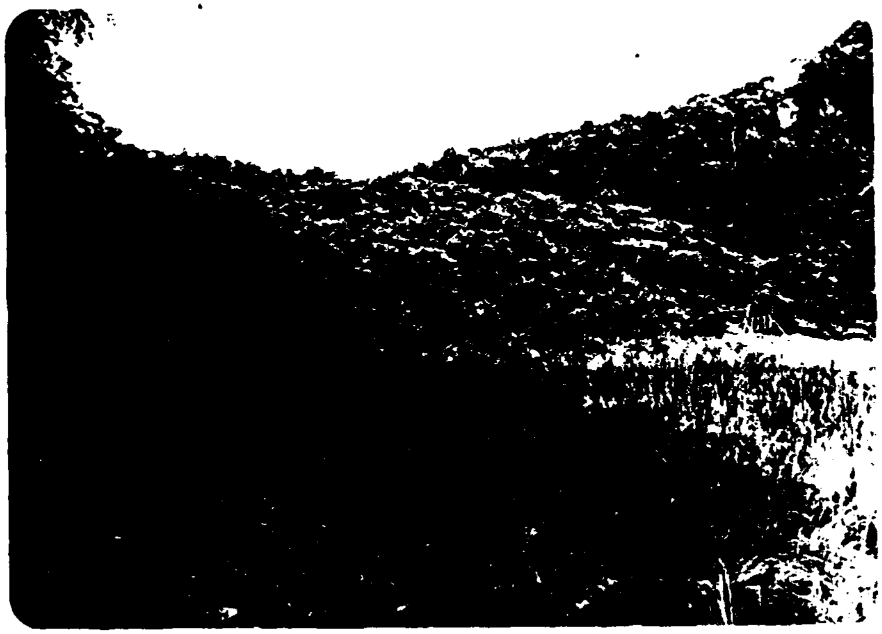
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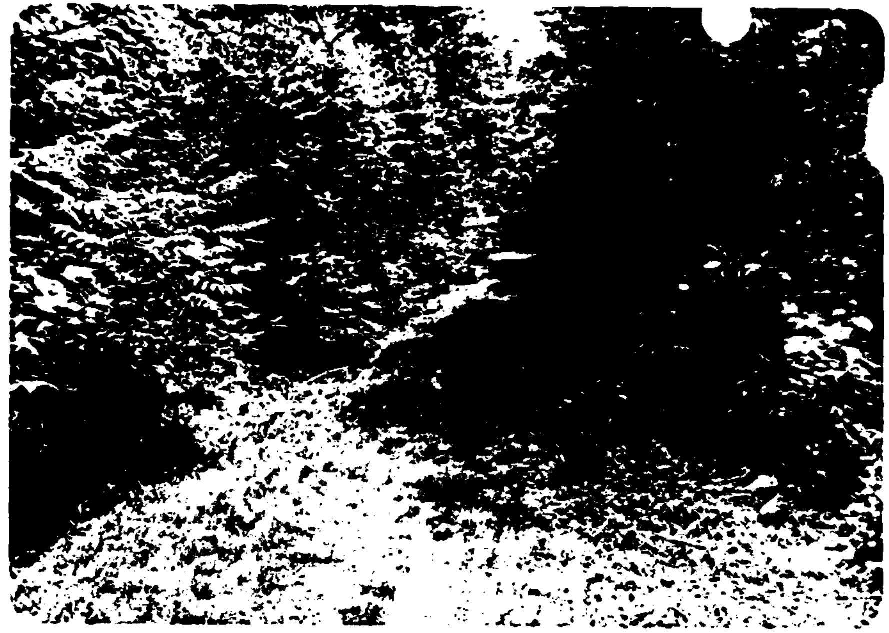
PHOTOGRAPH 5 View of the emergency spillway entrance located at the left abutment.

PHOTOGRAPH 6 View, looking downstream, of the emergency spillway channel.

PHOTOGRAPH 7 View of the emergency spillway control section looking toward the right abutment. Note the bituminous paving has been extended to protect the channel sidewall.

PHOTOGRAPH 8 View of the area immediately downstream of the embankment looking from the right abutment. The area in the foreground is saturated and poorly drained.

5



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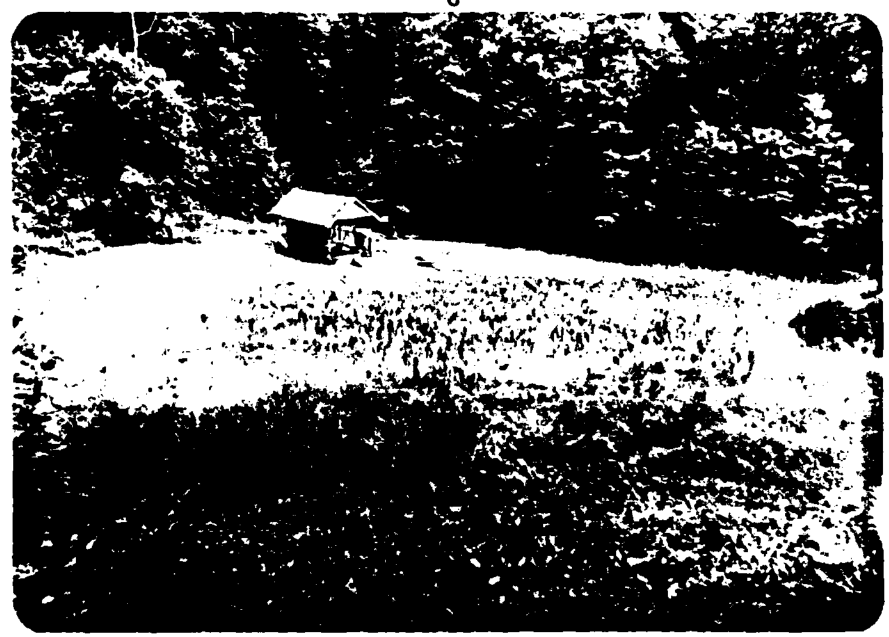

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PHOTOGRAPH 9	View of the reservoir area and service spillway riser as seen from the embankment crest.
PHOTOGRAPH 10	Close-up view of the service spillway-control tower riser.
PHOTOGRAPH 11	View of the discharge end of the outlet conduit located about 70 feet beyond the downstream embankment toe.
PHOTOGRAPH 12	View along Red Run approximately two miles downstream of the embankment near the community of Rouzerville, Pennsylvania.


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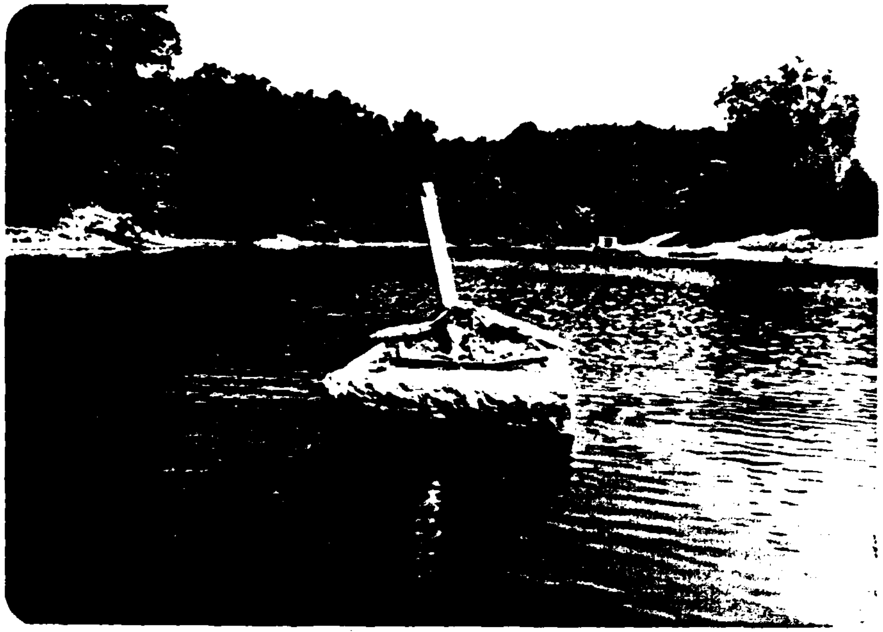
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APPENDIX D

HYDROLOGY AND HYDRAULICS ANALYSES

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevations of failure hydrographs for each location.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: COMET LAKE DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.6 INCHES/24 HOURS [(1)]

STATION	1	2	3
STATION DESCRIPTION	COMET LAKE DAM		
DRAINAGE AREA (SQUARE MILES)	0.29		
CUMULATIVE DRAINAGE AREA (SQUARE MILES)	-		
ADJUSTMENT OF PMF FOR DRAINAGE AREA LOCATION (%) [(1)]	Zone 6		
6 HOURS	113		
12 HOURS	123.5		
24 HOURS	132		
48 HOURS	143		
72 HOURS	-		
SNYDER HYDROGRAPH PARAMETERS			
ZONE (2)	32		
C_p (3)	0.75		
C_t (3)	1.90		
L (MILES) (4)	0.9		
L_{ca} (MILES) (4)	0.3		
$t_p = C_t\ (L \cdot L_{ca})^{0.3}$ (HOURS)	1.28		
SPILLWAY DATA (5)			
CREST LENGTH (FEET)	9.0		
FREEBOARD (FEET)	4.0		

(1) HYDROMETEOROLOGICAL REPORT - 33, U.S. ARMY COPRS OF ENGINEERS, 1955.

(2) HYDROLOGIC ZONE DEFINED BY CORPS OF ENGINEERS, BALTIMORE DISTRICT, FOR DETERMINATION OF SNYDER COEFFICIENTS (C_p AND C_t).

(3) SNYDER COEFFICIENTS

(4) L = LENGTH OF LONGEST WATERCOURSE FROM DAM TO BASIN DIVIDE.
L_{ca} = LENGTH OF LONGEST WATERCOURSE FROM DAM TO POINT OPPOSITE BASIN CENTROID.

(5) SEE SHEETS 6,7.

SUBJECT	DAM SAFETY INSPECTION
	COMET LAKE DAM
BY DJS	DATE 7-10-80
PROJ. NO. 79-203-796	
CHKD. BY WJV	DATE 7-29-80
SHEET NO. 1	OF 19

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DAM STATISTICS

HEIGHT OF DAM ≃ 38 FT (FIELD MEASURED: DOWNSTREAM TOE TO LOW TOP OF DAM.)

NORMAL POOL STORAGE CAPACITY ≃ 14.5×10^6 GALLONS
≃ 44.5 ACRE-FEET (FIGURE 2)

MAXIMUM POOL STORAGE CAPACITY = 62. AC-FT (SHEET 4)
(@ LOW TOP OF DAM)

DRAINAGE AREA = 0.29 SQ. MI. (PLANIMETERED ON USGS TOPO QUADS: SMITHSBURG AND BLUE RIDGE SUMMIT, PA)

ELEVATIONS:

TOP OF DAM (DESIGN)	= 974.0	(FIG. 3)
TOP OF DAM (FIELD)	= 972.8	
NORMAL POOL	= 968.0	(FIG. 2)
TOP OF RISER	= 968.0	(FIG. 2)
EMERGENCY SPILLWAY CREST (DESIGN)	= 970.0	(FIG. 4)
EMERGENCY SPILLWAY CREST (FIELD)	= 968.8	(SEE SHEET 7)
UPSTREAM INLET INVERT (DESIGN)	= 945.0	(FIG. 3)
DOWNSTREAM OUTLET INVERT	= 926.0	(FIG. 3)
STREAMBED AT DAM CENTERLINE	= 935	(ESTIMATED – FIG. 2)

SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY DJS DATE 7-10-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 2 OF 19

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DAM CLASSIFICATION

DAM SIZE: SMALL (REF 1, TABLE 1)

HAZARD CLASSIFICATION: HIGH (FIELD OBSERVATION)

REQUIRED SDF: ½PMF TO PMF (REF 1, TABLE 3)

HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE: $L = \underline{0.9}$ MILES

LENGTH OF LONGEST WATERCOURSE FROM DAM TO BASIN CENTROID: $L_{CA} = \underline{0.3}$ MILES

(MEASURED ON USGS TOPO QUADS — SMITHSBURG AND BLUE RIDGE SUMMIT, PA)

$C_p = 0.75$
$C_t = 1.90$

(SUPPLIED BY C.O.E.; ZONE 32, POTOMAC RIVER BASIN WEST OF MONOCACY RIVER)

t_p = SNYDER'S STANDARD LAG

$= C_t (L \times L_{CA})^{0.3}$

$= 1.90 (0.3 \times 0.9)^{0.3}$

$= \underline{1.28}$ HOURS.

NOTE: HYDROGRAPH VARIABLES USED HERE ARE DEFINED IN REF. 2, IN SECTION ENTITLED "SNYDER SYNTHETIC UNIT HYDROGRAPH."

RESERVOIR CAPACITY

RESERVOIR SURFACE AREAS:

- SURFACE AREA (S.A.) @ NORMAL POOL = 3.3 ACRES (FIG. 2)
  (ELEV. 968.0)
- S.A. @ ELEV. 980 = 5.3 ACRES
  (PLANIMETERED ON USGS TOPO - SMITHSBURG, PA)

IT IS ASSUMED THAT THE MODIFIED PRISMOIDAL RELATIONSHIP ADEQUATELY MODELS THE RESERVOIR SURFACE AREA - STORAGE RELATIONSHIP ABOVE NORMAL POOL. (REF 14, p.15)

$$\Delta V_{1-2} = \frac{h}{3}(A_1 + A_2 + \sqrt{A_1 A_2})$$

WHERE ΔV_{1-2} = INCREMENTAL VOLUME BETWEEN ELEVATIONS 1 & 2, IN AC-FT,
h = ELEVATION 1 - ELEVATION 2, IN FT,
A_1 = S.A. @ ELEV. 1, IN ACRES,
A_2 = S.A. @ ELEV. 2, IN ACRES.

ALSO,

$$A_i = A_0 + \left(\frac{\Delta SA}{\Delta H} \times H\right)$$

WHERE A_i = S.A. @ ELEV i, IN ACRES,
A_0 = S.A. @ NORMAL POOL = 3.3 ACRES,
$\frac{\Delta SA}{\Delta H}$ = RATE OF RESERVOIR AREA INCREASE PER FOOT RISE IN WATER LEVEL.

$$\rightarrow \frac{\Delta SA}{\Delta H} = \frac{(5.3 - 3.3)}{(980 - 968)} = \underline{0.17} \text{ AC/FT}$$

$$\rightarrow H = \text{ELEV } i - 968.0$$

SUBJECT	DAM SAFETY INSPECTION		
	COMET LAKE DAM		
BY DJS	DATE 7-10-80	PROJ. NO. 79-203-796	
CHKD. BY WJV	DATE 7-29-80	SHEET NO. 4	OF 19

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ELEVATION-STORAGE RELATIONSHIP:

	ELEVATION (FT)	A_i (AC)	ΔV_{1-2} (AC-FT)	TOTAL VOLUME (AC-FT)
	945.0*	0	-	0
(NORMAL POOL)	968.0	3.3	-	44.5**
	969.0	3.5	3.4	47.9
	970.0	3.6	3.5	51.4
	971.0	3.8	3.7	55.1
	972.0	4.0	3.9	59.0
(LOW TOP OF DAM)	972.8	4.1	3.2	62.2
	973.0	4.2	0.8	63.0
	974.0	4.3	4.2	67.2
	975.0	4.5	4.4	71.6
	976.0	4.7	4.6	76.2
	977.0	4.8	4.7	80.9
	978.0	5.0	4.9	85.8

* - ZERO-STORAGE ELEVATION ASSUMED AT UPSTREAM INLET INVERT.

** - VOLUME @ NORMAL POOL LISTED ON FIG. 2.

SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY DJS DATE 7-10-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 5 OF 19

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PMP CALCULATIONS

- APPROXIMATE RAINFALL INDEX = 23.6 INCHES (CORRESPONDING TO A DURATION OF 24 HOURS AND A DRAINAGE AREA OF 200 SQUARE MILES.)

(REF 3, FIG. 1)

- DEPTH-AREA-DURATION ZONE 6. (REF 3, FIG. 1)

- ASSUME DATA CORRESPONDING TO A 10-SQUARE MILE AREA MAY BE APPLIED TO THIS 0.3 SQUARE MILE BASIN:

DURATION (HOURS)	PERCENT OF INDEX RAINFALL
6	113
12	123.5
24	132
48	143

(REF 3, FIG. 3)

HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AND FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALL BASIN) FOR A DRAINAGE AREA OF 0.3 SQUARE MILES IS 0.80.

(REF 4, p. 48)

SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY DJS DATE 7-11-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 6 OF 19

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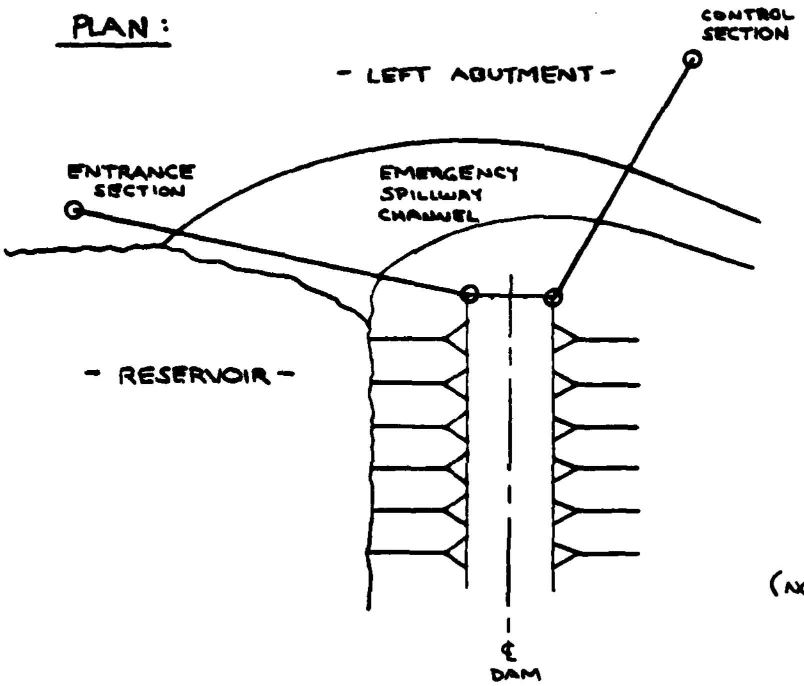
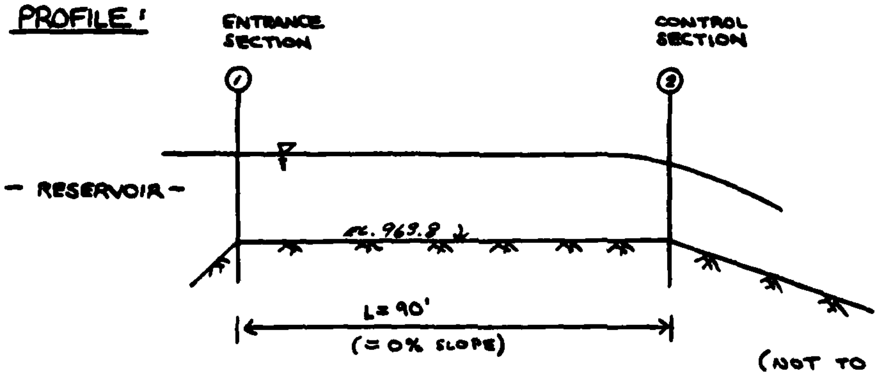
EMERGENCY SPILLWAY CAPACITY AND RATING CURVE

PLAN:



(NOT TO SCALE)

PROFILE:



(NOT TO SCALE)

(SKETCHES BASED ON FIELD SURVEY)

UBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY RJS DATE 7-11-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 7 OF 19

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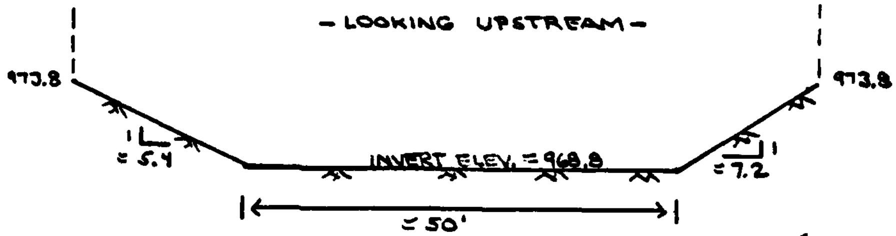
CROSS-SECTION @ ENTRANCE:

(SECTION 1)

– LOOKING UPSTREAM –

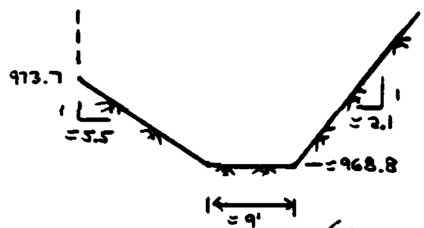


(NOT TO SCALE)

CROSS-SECTION @ CONTROL:

(SECTION 2)

– LOOKING UPSTREAM –



(NOT TO SCALE)

(APPROXIMATIONS OF SECTIONS MEASURED IN FIELD SURVEY)

THE SPILLWAY CONSISTS OF A CHUTE CHANNEL, APPROXIMATELY TRAPEZOIDAL IN CROSS-SECTION, CUT IN THE LEFT ABUTMENT. DISCHARGE IS DICTATED BY CRITICAL DEPTH AT THE CONTROL SECTION. CRITICAL FLOW CAN BE ESTIMATED BY THE RELATIONSHIP

$$\frac{Q^2 T}{g A^3} = 1.0 \qquad \text{(REF 5, p.8-7)}$$

WHERE Q = DISCHARGE, IN CFS,

T = TOP WIDTH OF FLOW AREA, IN FT,

g = GRAVITATIONAL ACCELERATION CONSTANT = 32.2 FT/SEC^2,

A = FLOW AREA, IN FT^2.

ALSO, $H_m = D_c + \frac{D_m}{2}$

(REF 5, p.8-8)

AND $D_m = A/T$,

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY DJS DATE 7-11-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 8 OF 19

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WHERE H_m = TOTAL HEAD AT CRITICAL DEPTH, OR MINIMUM SPECIFIC ENERGY, IN FT,
D_c = CRITICAL DEPTH, IN FT,
D_m = MEAN DEPTH OF FLOW AREA, IN FT.

ENERGY BALANCE BETWEEN SECTIONS ① AND ② (ENTRANCE SECTION AND CONTROL SECTION, RESPECTIVELY):

$$y_1 + \frac{V_1^2}{2g} + z_1 = y_2 + \frac{V_2^2}{2g} + z_2 + H_L \qquad \text{(REF 7, p. 40)}$$

WHERE y_1, y_2 = DEPTHS AT SECTIONS ① AND ②, RESPECTIVELY,
V_1, V_2 = VELOCITIES AT RESPECTIVE SECTIONS, IN FPS,
$z_1 = z_2$ = DATUM ELEVATION = 968.8,
H_L = TOTAL LOSSES IN APPROACH CHANNEL = ENTRANCE LOSS + FRICTION LOSS, IN FT.

$$\therefore \quad y_1 + \frac{V_1^2}{2g} = y_2 + \frac{V_2^2}{2g} + H_L$$
$$\simeq y_c + \frac{V_c^2}{2g} + H_L$$
$$\simeq H_m + H_L$$

CALCULATE Q @ $y_c \simeq$ 3.0 FT:

$$A_c = 9y_c + 3.8\,y_c^2$$
$$= 9(3.0) + 3.8(3.0)^2 = \underline{61.2}\ \text{FT}^2$$
$$T = 9 + (5.5+2.1)y_c$$
$$= 9 + (7.6)(3.0) = \underline{31.8}$$
$$D_m = A/T \simeq 61.2/31.8 = \underline{1.92}\ \text{FT}$$
$$H_m = D_c + D_m/2$$
$$\simeq 3.0 + 1.92/2 = \underline{4.0}\ \text{FT}$$

$$Q \simeq \sqrt{gA^3/T} = \underline{482}\ \text{CFS}$$

SUBJECT	DAM SAFETY INSPECTION COMET LAKE I M		
BY	DJS	DATE	7-11-80
PROJ. NO.	79-303-796		
CHKD. BY	WJV	DATE	7-29-80
SHEET NO.	9	OF	19

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FIND CORRESPONDING DEPTH AT ENTRANCE SECTION:

$$y_1 + \frac{Q^2}{A_1^2(2g)} \simeq H_m + H_L$$

$$y_1 + \frac{(482)^2}{A_1^2(2g)} \simeq 4.0 + H_L$$

ESTIMATE TOTAL LOSS: $H_L = h_e + h_F$

1) ENTRANCE LOSS: $h_e = 0.1\frac{V_1^2}{2g} = 0.1\frac{Q^2/A_1^2}{2g}$

(REF 4, p.379)

2) FRICTION LOSS: $h_F = \left[\frac{Qn}{1.49 A_{AVG} R_{AVG}^{2/3}}\right]^2 \times L_c$ (REF 4, p.379)

WHERE n = MANNING'S ROUGHNESS COEFFICIENT $\simeq 0.04$ (FIELD ESTIMATE),
A_{AVG} = AVERAGE FLOW AREA BETWEEN SECTIONS ① + ②,
R_{AVG} = AVERAGE HYDRAULIC RADIUS BETWEEN SECTIONS,
L_c = CHANNEL LENGTH $\simeq$ 90 FT.

$$A_{AVG} \simeq \frac{A_1 + A_2}{2}$$
$$\simeq \left(\tfrac{1}{2}\right)\left[(50y_1 + 6.3y_1^2) + (9y_1 + 3.8y_1^2)\right]$$
$$\simeq 29.5y_1 + 5.1y_1^2$$

(ASSUMING THAT y_1 IS A REASONABLE ESTIMATE OF THE CHANNEL DEPTH JUST UPSTREAM OF THE OCCURRENCE OF CRITICAL FLOW.)

$$R_{AVG} = \tfrac{1}{2}\left[\frac{A_1}{P_1} + \frac{A_2}{P_2}\right]$$

WHERE P_1, P_2 = WETTED PERIMETERS @ SECTIONS ① + ②.

$$R_{AVG} = \tfrac{1}{2}\left[\left(\frac{50y_1 + 6.3y_1^2}{50 + 12.8y_1}\right) + \left(\frac{9y_1 + 3.8y_1^2}{9 + 7.9y_1}\right)\right]$$

RE-WRITE ENERGY EQUATION:

$$y_1 + \frac{Q^2/A_1^2}{2g} \simeq H_m + \left(0.1\frac{Q^2/A_1^2}{2g}\right) + L_c\left[\frac{Qn}{1.49\left[29.5y_1 + 5.1y_1^2\right]\left\{\tfrac{1}{2}\left(\frac{50y_1 + 6.3y_1^2}{50 + 12.8y_1}\right) + \tfrac{1}{2}\left(\frac{9y_1 + 3.8y_1^2}{9 + 7.9y_1}\right)\right\}^{2/3}}\right]^2$$

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM
BY DJS DATE 7-14-80 PROJ. NO. 79-203-796
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OR,

$$y_1 + (0.9)\frac{(482)^2}{(2g)(50y_1 + 6.3y_1^2)^2} - 4.0$$

$$\simeq 90 \times \left[\frac{(482)(0.040)}{(1.49)\left[29.5y_1 + 5.1y_1^2\right]\left\{\frac{1}{2}\left(\frac{50y_1 + 6.3y_1^2}{50 + 12.8y_1}\right) + \frac{1}{2}\left(\frac{9y_1 + 3.8y_1^2}{9 + 7.9y_1}\right)\right\}^{2/3}}\right]^2$$

– BY TRIAL AND ERROR, AT $y_c = \underline{3.0}$ FT AND $Q = \underline{482}$ CFS,

$$y_1 = \underline{4.1} \text{ FT}, \text{ AND } H_L = \underline{0.1}$$

IT WILL BE ASSUMED THAT THE TOTAL LOSSES AT VALUES OTHER THAN $H_m = \underline{4.0}$ ARE PROPORTIONAL TO THAT AT $H_m = \underline{4.0}$:

$$H_L = 0.1\left(\frac{H_m}{4.0}\right).$$

THUS, THE ENERGY EQUATION CAN BE RE-WRITTEN:

$$y_1 + \frac{Q^2/A_1^2}{2g} = H_m + 0.1\left(\frac{H_m}{4.0}\right)$$

$$y_1 + \frac{Q^2/A_1^2}{2g} = 1.025\,H_m$$

THE SPILLWAY RATING CURVE IS GIVEN ON SHEET 11, BASED ON THE ABOVE EQUATION AND ON THE CRITICAL FLOW RELATIONSHIPS GIVEN ON SHEET 7.

SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY DJS DATE 7-14-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 11 OF 19

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SPILLWAY RATING TABLE:

D_c (FT)	① A_c (FT²)	② T (FT)	③ D_m (FT)	④ H_m (FT)	⑤ Q (CFS)	⑥ y_1 (FT)	⑦ RESERVOIR ELEVATION (FT)
—	—	—	—	—	0	0	968.8
0.7	8.2	14.3	0.57	1.0	35	1.0	969.8
1.5	22.1	20.4	1.08	2.0	131	2.0	970.8
2.2	38.2	25.7	1.49	2.9	264	3.0	971.8
2.9	58.1	31.0	1.87	3.8	451	3.9	972.7
3.0	61.2	31.8	1.92	4.0	482	4.1	972.9 *
3.3	71.1	34.1	2.09	4.3	583	4.4	973.2
3.7	85.3	37.1	2.30	4.9	734	5.0	973.8
4.1	100.8	40.2	2.51	5.4	906	5.5	974.3
4.5	117.5	43.2	2.72	5.9	1100	6.0	974.8
5.3	154.0	47.0	3.28	6.9	1582	7.0	975.8

* - LOW TOP OF DAM @ ELEV. 972.8; ASSUME AN INTERPOLATED VALUE OF $Q \simeq 470$ CFS AS SPILLWAY CAPACITY.

① FOR ELEV. ≤ 973.7 : $A_c = 9y_c + 3.8y_c^2$
FOR ELEV. ≥ 973.7 : $A_c = 135.3 + 46.2(y_c - 4.9) + 1.1(y_c - 4.9)^2$

② FOR ELEV ≤ 973.7 : $T = 9.0 + 7.6y_c$
FOR ELEV ≥ 973.7 : $T_c = 46.2 + 2.1(y_c - 4.9)$

③ $D_m = A/T$

④ $H_m = D_c + \frac{D_m}{2}$

⑤ $Q = \sqrt{gA_c^3/T}$

⑥ $y_1 + Q^2/2gA_1^2 \simeq 1.025 H_m$,
WHERE $A_1 = 50y_1 + 6.3y_1^2$ FOR ELEV ≤ 973.8
AND $A_1 \simeq 407.5 + 113.0(y_1 - 5.0)$ FOR ELEV ≥ 973.8

⑦ RESERVOIR ELEVATION = $968.8 + y_1$

EMBANKMENT RATING CURVE

ASSUME THAT THE EMBANKMENT BEHAVES ESSENTIALLY AS A BROAD-CRESTED WEIR WHEN OVERTOPPING OCCURS. THUS, THE DISCHARGE CAN BE ESTIMATED BY THE RELATIONSHIP:

$$Q = CLH^{3/2} \qquad \text{(REF 5, p. 5-23)}$$

WHERE
Q = DISCHARGE OVER EMBANKMENT, IN CFS,
L = LENGTH OF EMBANKMENT OVERTOPPED, IN FT,
H = HEAD, IN FT; IN THIS CASE IT IS THE AVERAGE "FLOW AREA WEIGHTED" HEAD ABOVE THE LOW TOP OF DAM,
C = COEFFICIENT OF DISCHARGE, DEPENDENT UPON THE HEAD AND THE WEIR BREADTH.

LENGTH OF EMBANKMENT INUNDATED VS. RESERVOIR ELEVATION:

RESERVOIR ELEVATION (FT)	EMBANKMENT LENGTH (FT)
972.8	0
973.0	50
973.2	85
973.5	120
973.8	170
974.0	300
974.3	300
974.8	300
975.8	305

(BASED ON FIELD SURVEY AND DESIGN DRAWINGS; LEFT SIDE-SLOPE = 3.5:1)

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY DJS DATE 7-14-80 PROJ. NO. 79-303-796

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ASSUME THAT INCREMENTAL DISCHARGES OVER THE EMBANKMENT FOR SUCCESSIVE RESERVOIR ELEVATIONS ARE APPROXIMATELY TRAPEZOIDAL IN CROSS-SECTIONAL FLOW AREA. THEN ANY INCREMENTAL AREA OF FLOW CAN BE ESTIMATED AS $H_i[(L_1+L_2)/2]$, WHERE L_1 = LENGTH OF OVERTOPPED EMBANKMENT AT HIGHER ELEVATION, L_2 = LENGTH AT LOWER ELEVATION, AND H_i = DIFFERENCE IN ELEVATIONS. THUS, THE TOTAL AVERAGE "FLOW AREA WEIGHTED" HEAD CAN BE ESTIMATED AS H_w = (TOTAL FLOW AREA/L_1).

EMBANKMENT RATING TABLE:

RESERVOIR ELEVATION (FT)	L_1 (FT)	L_2 (FT)	INCREMENTAL HEAD, H_i (FT)	INCREMENTAL FLOW AREA, A_i ① (FT^2)	TOTAL FLOW AREA, A_T (FT^2)	WEIGHTED HEAD, H_w ② (FT)	H_w/l ③	C ④	Q ⑤ (CFS)
972.8	0	–	–	–	–	–	–	–	0
973.0	50	0	0.2	5	5	0.1	0.01	2.93	0
973.2	85	50	0.2	14	19	0.2	0.01	2.97	20
973.5	120	85	0.3	31	50	0.4	0.02	3.01	90
973.8	170	120	0.3	44	94	0.6	0.03	3.03	240
974.0	300	170	0.2	47	141	0.5	0.03	3.02	320
974.3	300	300	0.3	90	231	0.8	0.04	3.03	650
974.8	300	300	0.5	150	381	1.3	0.07	3.04	1350
975.8	305	300	1.0	303	684	2.2	0.12	3.04	3030

① $A_i = H_i[(L_1+L_2)/2]$
② $H_w = (A_T/L_1)$
③ l = BREADTH OF CREST = 19 FT (FIELD MEASURED)
④ $C = f(H, l)$; FROM REF 12, FIG. 24
⑤ $Q = CL_1H_w^{3/2}$

SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY DJS DATE 7-14-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 14 OF 19

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TOTAL FACILITY RATING CURVE

$Q_{TOTAL} \cong Q_{EMERGENCY\ SPILLWAY} + Q_{EMBANKMENT}$

	RESERVOIR ELEVATION (FT)	$Q_{SPILLWAY}$ ① (CFS)	$Q_{EMBANKMENT}$ ② (CFS)	Q_{TOTAL} ③ (CFS)
	968.8	0	–	0
	969.8	40	–	40
	970.8	130	–	130
	971.8	260	–	260
(LOW TOP OF DAM)	972.8	470	0	470
	973.0	520	0	520
	973.2	580	20	600
	973.5	660	90	750
	973.8	730	240	970
	974.0	800	320	1120
	974.3	910	650	1560
	974.8	1100	1350	2450
	975.8	1580	3030	4610

① VALUES OBTAINED FROM OR LINEARLY INTERPOLATED FROM TABLE ON SHEET 11; ROUNDED TO NEAREST 10 CFS.

② FROM TABLE ON SHEET 13.

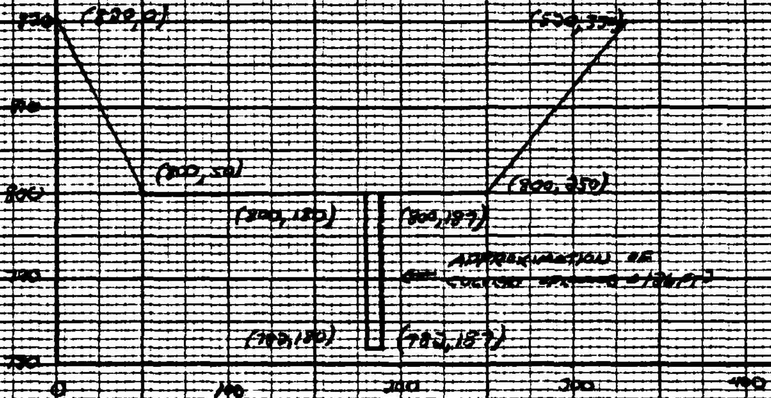
③ DISCHARGE FROM THE 12" SERVICE SPILLWAY CULVERT IS NOT CONSIDERED HERE, SINCE THE MAGNITUDE OF ITS CAPACITY IS SMALL IN COMPARISON TO EXPECTED PMF DISCHARGES.

SUBJECT Comet Lake Dam

BY DJS DATE 7-25-84 SHEET NO. 15 OF 19

CHKD. BY WJV DATE 7-27-85 PROJECT NO. 79-303-196

DOWNSTREAM ROUTING SECTIONS



SECTION 2.0

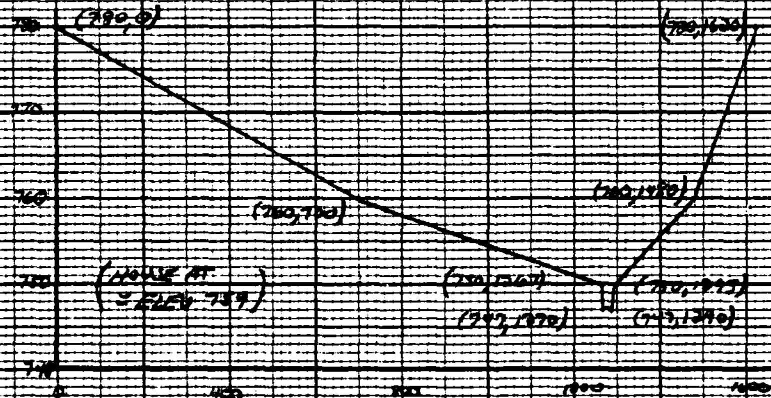
≅ 3540 FT D.S. FROM DAM

INVERT ≅ 783.0

CHANNEL SLOPE ≅ 0.043

$n_{LOB} = 0.100$, $n_{ROB} = 0.040$

$n_{CH} = 0.040$



SECTION 3.0

≅ 5380 FT D.S. FROM DAM

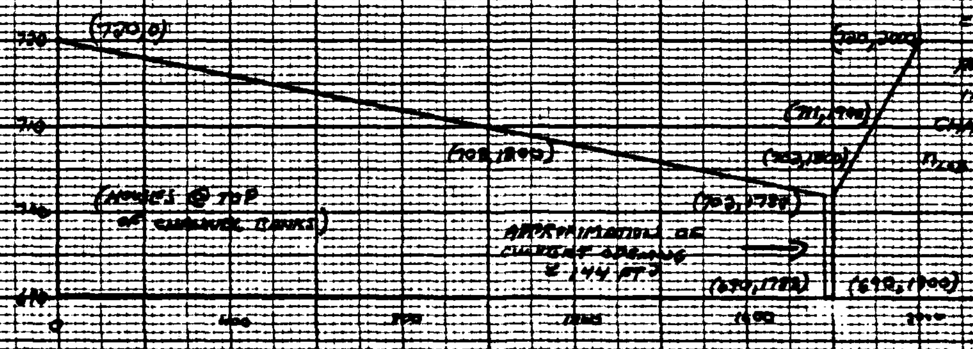
REACH LENGTH = 1840 FT

INVERT ≅ 747.0

CHANNEL SLOPE ≅ 0.020

$n_{LOB} = n_{ROB} = 0.080$

$n_{CH} = 0.035$



SECTION 4.0

≅ 9160 FT D.S. FROM DAM

REACH LENGTH ≅ 3780'

INVERT ≅ 690.0

CHANNEL SLOPE ≅ 0.014

$n_{LOB} = n_{ROB} = 0.090$

$n_{CH} = 0.075$

NOTE: SECTIONS BASED ON FIELD NOTES AND OBSERVATIONS AND USGS TOPO QUAD - SMITHSBURG, PA. ELEVATIONS ARE CONSIDERED ESTIMATES AND ARE NOT NECESSARILY ACCURATE.

SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY DJS DATE 7-25-80 PROJ. NO. 79-203-196

CHKD. BY WJV DATE 7-29-80 SHEET NO. 16 OF 19

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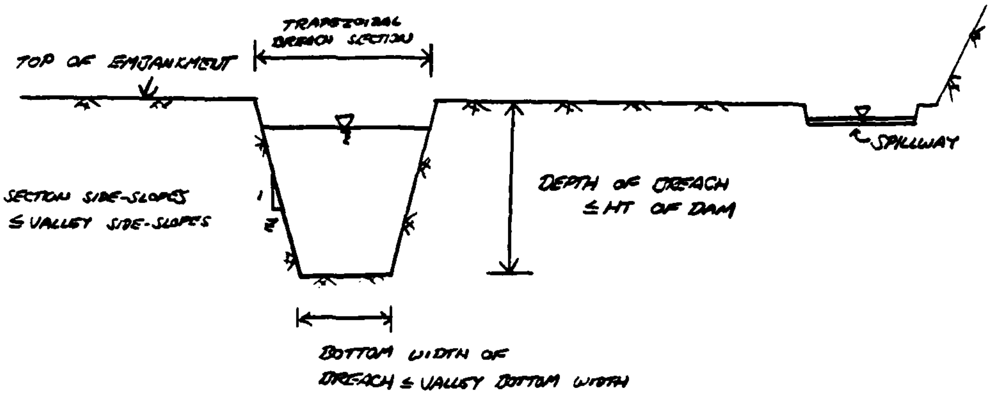
BREACH ASSUMPTIONS

TYPICAL BREACH SECTION:



HEC-1 DAM BREACHING ANALYSIS INPUT:

(ASSUME BREACHING COMMENCES WHEN RESERVOIR LEVEL REACHES LOW TOP OF DAM ELEVATION: 972.8)

PLAN	BREACH BOTTOM WIDTH (FT)	MAX. BREACH DEPTH (FT)	SECTION SIDE-SLOPES	BREACH TIME (HRS)	W.S. EL. AT START OF FAILURE (FT)
① MIN. BREACH SECTION, MIN. FAIL TIME	0	28	1H:1V	0.5	972.8
② MAX. BREACH SECTION, MIN. FAIL TIME	150	28	2.5:1	0.5	972.8
③ MIN. BREACH SECTION, MAX. FAIL TIME	0	28	1:1	4.0	972.8
④ MAX. BREACH SECTION, MAX. FAIL TIME	150	28	2.5:1	4.0	972.8
⑤ AVERAGE POSSIBLE CONDITIONS	90	28	1:1	2.0	972.8

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY DJS DATE 7-25-80 PROJ. NO. 79-303-796

CHKD. BY WJV DATE 7-29-80 SHEET NO. 17 OF 19

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THE BREACH ASSUMPTIONS LISTED ON SHEET 16 ARE BASED ON THE SUGGESTED RANGES PROVIDED BY THE C.O.E. (BALTIMORE DISTRICT), AND ON THE PHYSICAL CONSTRAINTS OF THE DAM AND THE SURROUNDING TERRAIN:

- DEPTH OF BREACH OPENING = 27.8 FT (TOP OF DAM TO MINIMUM RESERVOIR ELEVATION)
- LENGTH OF BREACHABLE EMBANKMENT = 295 FT (FIELD MEASURED)
- VALLEY BOTTOM WIDTH = 150 FT (FIELD OBSERVATION, & USGS TOPO - SMITHSBURG, PA)
- VALLEY SIDE-SLOPES ADJACENT TO DAM:

LEFT SIDE: 3H:1V
RIGHT SIDE: 6H:1V
(USGS TOPO - SMITHSBURG, PA)

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY DJJ DATE 7-28-80 PROJ. NO. 79-203-796
CHKD. BY WJV DATE 7-30-80 SHEET NO. 18 OF 19

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HEC-1 DAM BREACHING ANALYSIS OUTPUT:

RESERVOIR DATA: (UNDER 0.45 PMF BASE FLOOD CONDITIONS)

PLAN # NUMBER	VARIABLE BREACH BOTTOM WIDTH (FT)	ACTUAL MAX FLOW DURING FAIL TIME (CFS)	CORRESPONDING TIME OF PEAK (HRS)	INTERPOLATED OR HEC-1 ROUTED MAX FLOW DURING FAIL TIME (CFS)	CORRESPONDING TIME OF PEAK (HRS)	ACTUAL PEAK FLOW THROUGH DAM (CFS)	CORRESPONDING TIME OF PEAK (HRS)	TIME OF INITIAL BREACH (HRS)
1	0	2068	41.19	1949	41.17	2068	41.19	40.83
2	150	2708	40.97	2059	41.00	2708	40.97	40.83
3	0	488	41.08	488	41.17	488	41.08	40.83
4	150	731	41.17	731	41.17	731	41.17	40.83
5	90	1570	41.10	1449	41.00	1570	41.10	40.83

* SEE SHEET 16.

SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY DJS DATE 7-28-80 PROJ. NO. 79-203-796

CHKD. BY WJV DATE 7-30-80 SHEET NO. 19 OF 19

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DOWNSTREAM ROUTING DATA:

@ SECTION 4.0: (UNDER 0.45 PMF BASE FLOOD CONDITIONS)

PLAN NUMBER ①	VARIABLE BREACH BOTTOM WIDTH (FT)	PEAK FLOW (CFS)	CORRESPONDING W.S. EL. ② (FT)	W.S. EL. W/O BREACH ③ (FT)	ELEVATION DIFFERENCE ④ (FT)
①	0	1615	700.8	694.3	+ 6.5
②	150	1792	701.7	694.3	+ 7.4
③	0	487	694.3	694.3	—
④	150	727	695.8	694.3	+ 1.5
⑤	90	1271	699.0	694.3	+ 4.7

① SEE SHEET 16.

② WATER SURFACE ELEVATION CORRESPONDING TO MAX. BREACH OUTFLOW (SUMMARY INPUT/OUTPUT SHEETS, SHEET L)

③ BASE FLOW ELEVATION CORRESPONDING TO THE PEAK 0.45PMF AS INTERPOLATED FROM SHEET E, SUMMARY INPUT/OUTPUT SHEETS.

④ ELEV. DIFF. = (CORRESPONDING W.S.EL.) − (W.S.EL. W/O BREACH)

NOTE: DAMAGE ELEVATION OF RESIDENCES AT TOP OF CHANNEL BANKS, APPROXIMATED AT ELEV. 702.0.

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

CHKD. BY DJS DATE 7-29-80 SHEET NO. A OF L

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SUMMARY INPUT/OUTPUT SHEETS

OVERTOPPING ANALYSIS

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DAM SAFETY INSPECTION
COMET LAKE DAM **** OVERTOPPING ANALYSIS ****
10-MINUTE TIME STEP AND 48-HOUR STORM DURATION

                          JOB SPECIFICATION
   NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
  288       0      10       0       0       0       0       0       0       0
                        JOPER     NWT   LROPT   TRACE
                            5       0       0       0

                  MULTI-PLAN ANALYSES TO BE PERFORMED
                     NPLAN= 1 NRTIO= 4 LRTIO= 1
     RTIOS=    .30    .40    .50   1.00

*********        *********        *********        *********        *********

                        SUB-AREA RUNOFF COMPUTATION

  RESERVOIR INFLOW

           ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
               1       0       0       0       0       0       1       0       0

                            HYDROGRAPH DATA
   IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
       1       1     .29    0.00     .29    0.00   0.000       0       1       0

                              PRECIP DATA
              SPFE     PMS      R6     R12     R24     R48     R72     R96
              0.00   23.60  113.00  123.50  132.00  143.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS  .800
                                         INITIAL AND CONSTANT RAINFALL
                                           LOSSES AS PER CDE
                               LOSS DATA
  LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
      0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .05    0.00    0.00

                         UNIT HYDROGRAPH DATA
                    TP=  1.28     CP= .75     NTA=  0
BASE FLOW PARAMETERS
AS PER CDE
                          RECESSION DATA
             STRTQ=   -1.50    QRCSN=    -.05    RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 9.37 AND R= 4.68 INTERVALS

     UNIT HYDROGRAPH 30 END-OF-PERIOD ORDINATES, LAG=  1.28 HOURS, CP=  .75  VOL= 1.00
     5.      19.      38.      58.      79.      96.     107.     111.     108.      95.
    78.      63.      51.      41.      33.      27.      22.      17.      14.      11.
     9.       7.       6.       5.       4.       3.       3.       2.       2.       1.
```

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

CHKD. BY DJS DATE 7-29-80 SHEET NO. 8 OF L

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END-OF-PERIOD FLOW

NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	27.00	24.59	2.41	27386.
										(686.)(	624.)(	61.)(	775.49)

RESERVOIR INFLOW HYDROGRAPHS

0.3 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	331.	103.	55.	29.	8212.
CMS	9.	3.	2.	1.	233.
INCHES		5.87	7.05	7.32	7.32
MM		149.12	179.11	185.87	185.87
AC-FT		91.	109.	113.	113.
THOUS CU FT		112.	134.	140.	140.

0.4 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	441.	244.	73.	38.	10950.
CMS	12.	7.	2.	1.	310.
INCHES		7.83	9.40	9.76	9.76
MM		198.83	238.82	247.82	247.82
AC-FT		121.	145.	151.	151.
THOUS CU M		149.	179.	186.	186.

0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	551.	305.	92.	48.	13687.
CMS	16.	9.	3.	1.	388.
INCHES		9.78	11.75	12.20	12.20
MM		248.54	298.52	309.78	309.78
AC-FT		151.	182.	189.	189.
THOUS CU M		187.	224.	233.	233.

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1103.	610.	183.	95.	27375.
CMS	31.	17.	5.	3.	775.
INCHES		19.57	23.51	24.39	24.39
MM		497.07	597.04	619.55	619.55
AC-FT		303.	363.	377.	377.
THOUS CU M		373.	448.	465.	465.

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HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	45.	-1

SUBJECT: DAM SAFETY INSPECTION
COMET LAKE DAM

BY: WJV DATE: 7-28-80 PROJ. NO. 79-203-796
CHKD. BY: DJS DATE: 7-29-80 SHEET NO. C OF L

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STAGE	968.80	969.80	970.80	971.80	972.80	973.00	973.20	973.50	973.80
	974.30	974.80	975.80						
FLOW	0.00	40.00	130.00	260.00	470.00	520.00	600.00	750.00	970.00
	1560.00	2450.00	4610.00						
CAPACITY=	0.	45.	48.	51.	55.	59.	62.	63.	67.	72.
	76.	81.	86.						
ELEVATION=	945.	968.	969.	970.	971.	972.	973.	973.	974.	975.
	976.	977.	978.						

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
968.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
972.8	0.0	0.0	0.

RESERVOIR OUTFLOW HYDROGRAPHS

0.3 PMF

PEAK OUTFLOW IS 319. AT TIME 41.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	319.	180.	55.	28.	7961.
INCHES		5.77	7.01	7.09	7.09
MM		146.59	177.96	180.17	180.17
AC-FT		89.	108.	110.	110.
THOUS CU M		110.	134.	135.	135.

0.4 PMF

PEAK OUTFLOW IS 428. AT TIME 41.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	428.	241.	73.	37.	10683.
CMS	12.	7.	2.	1.	302.
INCHES		7.72	9.34	9.52	9.52
MM		196.06	237.32	241.77	241.77
AC-FT		119.	144.	147.	147.
THOUS CU M		147.	178.	181.	181.

0.5 PMF

PEAK OUTFLOW IS 542. AT TIME 41.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	542.	301.	91.	47.	13404.
CMS	15.	9.	3.	1.	380.
INCHES		9.67	11.68	11.94	11.94
MM		245.57	296.69	303.36	303.36
AC-FT		149.	181.	185.	185.
THOUS CU M		184.	223.	228.	228.

PMF

PEAK OUTFLOW IS 1098. AT TIME 40.83 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1098.	606.	182.	94.	27020.
INCHES		19.45	23.37	24.08	24.08
MM		493.94	593.70	611.53	611.53
AC-FT		301.	361.	372.	372.
THOUS CU M		371.	446.	459.	459.

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796
CHKD. BY DJS DATE 7-29-80 SHEET NO. D OF L

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HYDROGRAPH ROUTING

ROUTE FROM DAM TO SECTION 2, 3540 FT D.S. FROM DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
102	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0400	.0800	782.0	820.0	3540.	.04300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 820.00 50.00 800.00 180.00 800.00 180.00 782.00 187.00 782.00
187.00 800.00 250.00 800.00 330.00 820.00

STORAGE	0.00	1.14	2.28	3.41	4.55	5.69	6.83	7.96	9.10
	43.06	79.48	117.27	157.17	199.19	243.31	289.56	337.91	388.30
OUTFLOW	0.00	127.00	327.89	550.52	782.87	1020.43	1261.11	1503.81	1747.89
	4445.29	9436.43	16468.92	25383.26	36108.79	48615.41	62895.36	78954.51	96807.62
STAGE	782.00	784.00	786.00	788.00	790.00	792.00	794.00	796.00	798.00
	802.00	804.00	806.00	808.00	810.00	812.00	814.00	816.00	818.00
FLOW	0.00	127.00	327.89	550.52	782.87	1020.43	1261.11	1503.81	1747.89
	4445.29	9436.43	16468.92	25383.26	36108.79	48615.41	62895.36	78954.51	96807.62

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HYDROGRAPH ROUTING

ROUTE FROM SECTION 2 TO SECTION 3, 5380 FT D.S. FROM DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
203	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

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NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0350	.0800	747.0	780.0	1840.	.02000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 780.00 700.00 760.00 1267.00 750.00 1270.00 747.00 1290.00 747.00
1293.00 750.00 1480.00 760.00 1620.00 780.00

STORAGE	0.00	1.59	3.79	13.12	32.06	60.61	98.77	146.53	203.33
	334.00	407.36	486.08	570.14	659.56	754.33	854.45	959.92	1070.74
OUTFLOW	0.00	299.88	993.70	2575.47	5855.28	11485.42	20025.19	31980.44	48545.97
	94979.27	124328.46	157946.65	195981.05	238583.23	285906.96	338106.86	395337.58	457753.25
STAGE	747.00	748.74	750.47	752.21	753.95	755.68	757.42	759.16	760.89
	764.37	766.11	767.84	769.58	771.32	773.05	774.79	776.53	778.26
FLOW	0.00	299.88	993.70	2575.47	5855.28	11485.42	20025.19	31980.44	48545.97
	94979.27	124328.46	157946.65	195981.05	238583.23	285906.96	338106.86	395337.58	457753.25

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HYDROGRAPH ROUTING

ROUTE FROM SECTION 3 TO SECTION 4. 9160 FT D.S. FROM DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
304	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0900	.0350	.0900	690.0	720.0	3780.	.01400

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 720.00 1200.00 708.00 1780.00 702.00 1788.00 690.00 1800.00 690.00
1808.00 702.00 1900.00 711.00 2000.00 720.00

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

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STORAGE	0.00	1.64	3.29	4.93	6.58	8.22	9.87	11.51	15.04
	84.42	154.52	248.31	366.09	507.92	673.78	863.68	1077.61	1315.59
OUTFLOW	0.00	110.75	309.93	547.89	807.61	1080.92	1363.33	1652.14	2010.64
	5236.88	9331.76	15727.43	24872.78	37185.80	53048.24	72821.97	96852.62	125472.17
STAGE	690.00	691.58	693.16	694.74	696.32	697.89	699.47	701.05	702.63
	705.79	707.37	708.95	710.53	712.11	713.68	715.26	716.84	718.42
FLOW	0.00	110.75	309.93	547.89	807.61	1080.92	1363.33	1652.14	2010.64
	5236.88	9331.76	15727.43	24872.78	37185.80	53048.24	72821.97	96852.62	125472.17

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	968.00	968.00	972.80
STORAGE	45.	45.	62.
OUTFLOW	0.	0.	470.

OVERTOPPING OCCURS @ ≈ 0.44 PMF

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	972.08	0.00	59.	319.	0.00	41.00	0.00
.40	972.60	0.00	61.	428.	0.00	41.00	0.00
.50	973.06	.26	63.	542.	1.00	41.00	0.00
1.00	973.97	1.17	67.	1098.	3.67	40.83	0.00

PLAN 1 STATION 102

SECTION 2 @ 3540 FT DS FROM DAM

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.30	318.	785.9	41.17
.40	426.	786.9	41.17
.50	539.	787.9	41.00
1.00	1096.	792.6	41.00

PLAN 1 STATION 203

SECTION 3 @ 5380 FT DS FROM DAM

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.30	318.	748.8	41.17
.40	427.	749.1	41.17
.50	537.	749.3	41.17
1.00	1095.	750.6	41.00

PLAN 1 STATION 304

SECTION 4 @ 9160 FT DS FROM DAM

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.30	315.	693.2	41.33
.40	425.	693.9	41.17
.50	537.	694.7	41.17
1.00	1087.	697.9	41.17

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

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BREACHING ANALYSIS:

(INPUT DATA IS SAME AS FOR OVERTOPPING ANALYSIS WITH THE ADDITION OF THE BREACH DATA GIVEN HERE)

DAM SAFETY INSPECTION
COMET LAKE DAM **** BREACHING ANALYSIS ****
10-MINUTE TIME STEP AND 48-HOUR STORM DURATION

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	10	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 5 NRTIO= 1 LRTIO= 1

RTIOS= .45

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HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR

DAM DATA

TOPEL	COQD	EXPD	DAMWID
972.8	0.0	0.0	0.

PLAN ①

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
0.	1.00	945.00	.50	968.00	972.80

STATION 101, PLAN 1, RATIO 1

BEGIN DAM FAILURE AT 40.83 HOURS

PEAK OUTFLOW IS 2068. AT TIME 41.19 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1949.	363.	105.	53.	15327.
CMS	55.	10.	3.	2.	434.
INCHES		11.64	13.44	13.66	13.66
MM		295.66	341.32	346.88	346.88
AC-FT		180.	208.	211.	211.
THOUS CU M		222.	256.	260.	260.

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

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PLAN 2

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
150.	2.50	945.00	.50	968.00	972.80

STATION 101. PLAN 2. RATIO 1

BEGIN DAM FAILURE AT 40.83 HOURS

PEAK OUTFLOW IS 2708. AT TIME 40.97 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2059.	363.	102.	52.	15005.
CMS	58.	10.	3.	1.	425.
INCHES		11.65	13.15	13.37	13.37
MM		295.95	334.03	339.59	339.59
AC-FT		180.	203.	207.	207.
THOUS CU M		222.	251.	255.	255.

PLAN 3

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
0.	1.00	945.00	4.00	968.00	972.80

STATION 101. PLAN 3. RATIO 1

BEGIN DAM FAILURE AT 40.83 HOURS

PEAK OUTFLOW IS 488. AT TIME 41.08 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	488.	341.	104.	53.	15269.
CMS	14.	10.	3.	2.	432.
INCHES		10.95	13.39	13.61	13.61
MM		278.21	340.01	345.57	345.57
AC-FT		169.	207.	210.	210.
THOUS CU M		209.	255.	259.	259.

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SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

CHKD. BY DJS DATE 7-29-80 SHEET NO. I OF L

PLAN ④

DAM BREACH DATA					
BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
150.	2.50	945.00	4.00	968.00	972.80

STATION 101, PLAN 4, RATIO 1

BEGIN DAM FAILURE AT 40.83 HOURS

PEAK OUTFLOW IS 731. AT TIME 41.17 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	731.	362.	106.	54.	15558.
CMS	21.	10.	3.	2.	441.
INCHES		11.60	13.64	13.86	13.86
MM		294.58	346.56	352.12	352.12
AC-FT		179.	211.	214.	214.
THOUS CU M		221.	260.	264.	264.

PLAN ⑤

DAM BREACH DATA					
BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
90.	1.00	945.00	1.00	968.00	972.80

STATION 101, PLAN 5, RATIO 1

BEGIN DAM FAILURE AT 40.83 HOURS

PEAK OUTFLOW IS 1570. AT TIME 41.10 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1449.	377.	106.	54.	15528.
CMS	41.	11.	3.	2.	440.
INCHES		12.11	13.62	13.84	13.84
MM		307.50	345.88	351.44	351.44
AC-FT		187.	211.	214.	214.
THOUS CU M		231.	260.	264.	264.

SUBJECT DAM SAFETY INSPECTION
COMET LAKE DAM

BY WJV DATE 7-28-80 PROJ. NO. 79-203-796

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THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .010 HOURS DURING BREACH FORMATION.
DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .167 HOURS.
THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.
INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

PLAN 2

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	-	COMPUTED BREACH HYDROGRAPH (CFS)	=	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
40.833	0.000	472.		472.		0.	0.	0.
40.843	.010	565.		652.		-87.	-87.	-0.
40.853	.020	658.		939.		-281.	-368.	-0.
40.863	.029	752.		1248.		-497.	-864.	-1.
40.873	.039	845.		1542.		-697.	-1561.	-1.
40.882	.049	938.		1802.		-863.	-2425.	-2.
40.892	.059	1032.		2019.		-987.	-3412.	-3.
40.902	.069	1125.		2207.		-1082.	-4494.	-4.
40.912	.078	1219.		2365.		-1146.	-5640.	-5.
40.922	.088	1312.		2476.		-1164.	-6804.	-6.
40.931	.098	1405.		2564.		-1158.	-7962.	-6.
40.941	.108	1499.		2621.		-1122.	-9084.	-7.
40.951	.118	1592.		2659.		-1067.	-10151.	-8.
40.961	.127	1686.		2685.		-1000.	-11151.	-9.
40.971	.137	1779.		2708.		-929.	-12079.	-10.
40.980	.147	1872.		2571.		-699.	-12778.	-10.
40.990	.157	1966.		2244.		-278.	-13056.	-11.
41.000	.167	2059.		2059.		-0.	-13056.	-11.
41.010	.176	2042.		1951.		91.	-12965.	-11.
41.020	.186	2024.		1886.		138.	-12827.	-10.
41.029	.196	2007.		1846.		161.	-12666.	-10.
41.039	.206	1990.		1821.		168.	-12498.	-10.
41.049	.216	1972.		1806.		167.	-12331.	-10.
41.059	.225	1955.		1795.		160.	-12172.	-10.
41.069	.235	1937.		1788.		149.	-12022.	-10.
41.078	.245	1920.		1783.		137.	-11886.	-10.
41.088	.255	1903.		1780.		123.	-11763.	-10.
41.098	.265	1885.		1777.		108.	-11654.	-9.
41.108	.275	1868.		1774.		93.	-11561.	-9.
41.118	.284	1850.		1772.		78.	-11483.	-9.
41.127	.294	1833.		1770.		63.	-11420.	-9.
41.137	.304	1816.		1769.		47.	-11373.	-9.
41.147	.314	1798.		1767.		31.	-11341.	-9.
41.157	.324	1781.		1765.		16.	-11326.	-9.
41.167	.333	1763.		1763.		0.	-11326.	-9.
41.176	.343	1761.		1762.		-0.	-11326.	-9.
41.186	.353	1759.		1760.		-1.	-11326.	-9.
41.196	.363	1757.		1758.		-1.	-11327.	-9.
41.206	.373	1755.		1756.		-1.	-11328.	-9.
41.216	.382	1753.		1754.		-1.	-11328.	-9.
41.225	.392	1751.		1752.		-1.	-11329.	-9.
41.235	.402	1749.		1749.		-1.	-11330.	-9.
41.245	.412	1747.		1747.		-1.	-11330.	-9.
41.255	.422	1745.		1745.		-0.	-11331.	-9.
41.265	.431	1742.		1743.		-0.	-11331.	-9.
41.275	.441	1740.		1741.		-0.	-11331.	-9.
41.284	.451	1738.		1739.		-0.	-11332.	-9.
41.294	.461	1736.		1736.		-0.	-11332.	-9.
41.304	.471	1734.		1734.		-0.	-11332.	-9.
41.314	.480	1732.		1732.		-0.	-11332.	-9.
41.324	.490	1730.		1730.		-0.	-11332.	-9.
41.333	.500	1728.		1728.		0.	-11332.	-9.

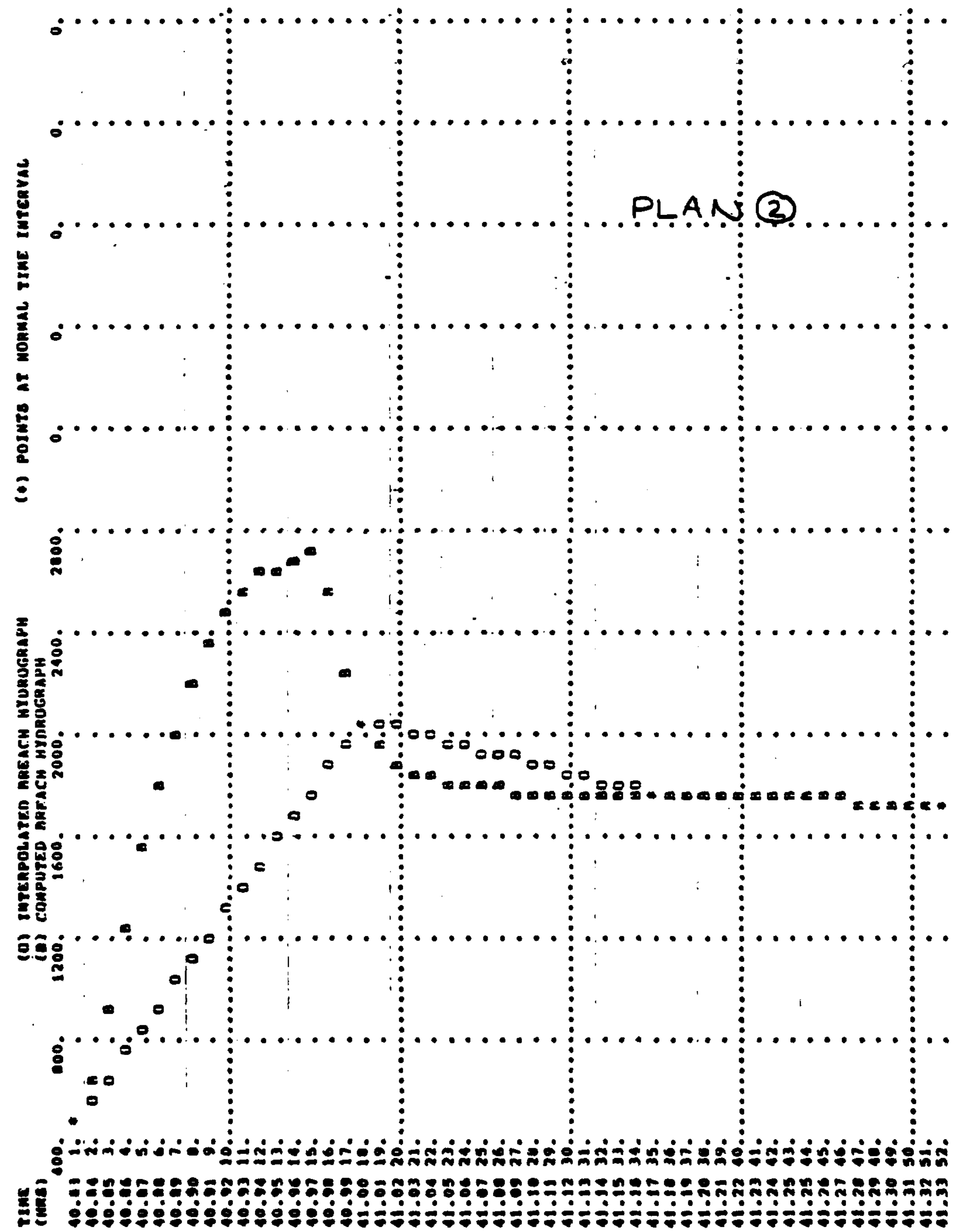
SUBJECT DAM SAFETY INSPECTION

COMET LAKE DAM

BY WJV DATE 7-29-80 PROJ. NO. 79-203-796

CHKD. BY DJS DATE 7-29-80 SHEET NO. K OF L

gai CONSULTANTS
Engineers • Geologists • Pl
Environmental Specialists



SUBJECT: DAM SAFETY INSPECTION
COMET LAKE DAM

BY: WJV DATE: 7-29-80 PROJ. NO.: 79-203-796
CHKD. BY: DJS DATE: 7-27-80 SHEET NO.: L OF L

gai CONSULTANTS
Engineers • Geologists • P
Environmental Specialists

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	968.00	968.00	972.80
STORAGE	45.	45.	62.
OUTFLOW	0.	0.	470.

PLAN	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1	.45	972.82	.02	62.	2068.	.24	41.19	40.83
2	.45	972.81	.01	62.	2708.	.17	40.97	40.83
3	.45	972.85	.05	62.	488.	.42	41.08	40.83
4	.45	972.81	.01	62.	731.	.17	41.17	40.83
5	.45	972.81	.01	62.	1570.	.17	41.10	40.83

SECTION 1: STATION 102

PLAN	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1	.45	1919.	799.4	41.33
2	.45	2002.	800.0	41.17
3	.45	488.	787.4	41.17
4	.45	739.	789.6	41.17
5	.45	1387.	795.0	41.17

SECTION 2: STATION 203

PLAN	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1	.45	1783.	751.3	41.33
2	.45	1860.	751.4	41.33
3	.45	497.	749.2	41.17
4	.45	732.	749.8	41.33
5	.45	1271.	750.8	41.17

SECTION 3: STATION 304

PLAN	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1	.45	1615.	700.8	41.50
2	.45	1792.	701.7	41.33
3	.45	487.	694.3	41.33
4	.45	727.	695.8	41.33
5	.45	1271.	699.0	41.33

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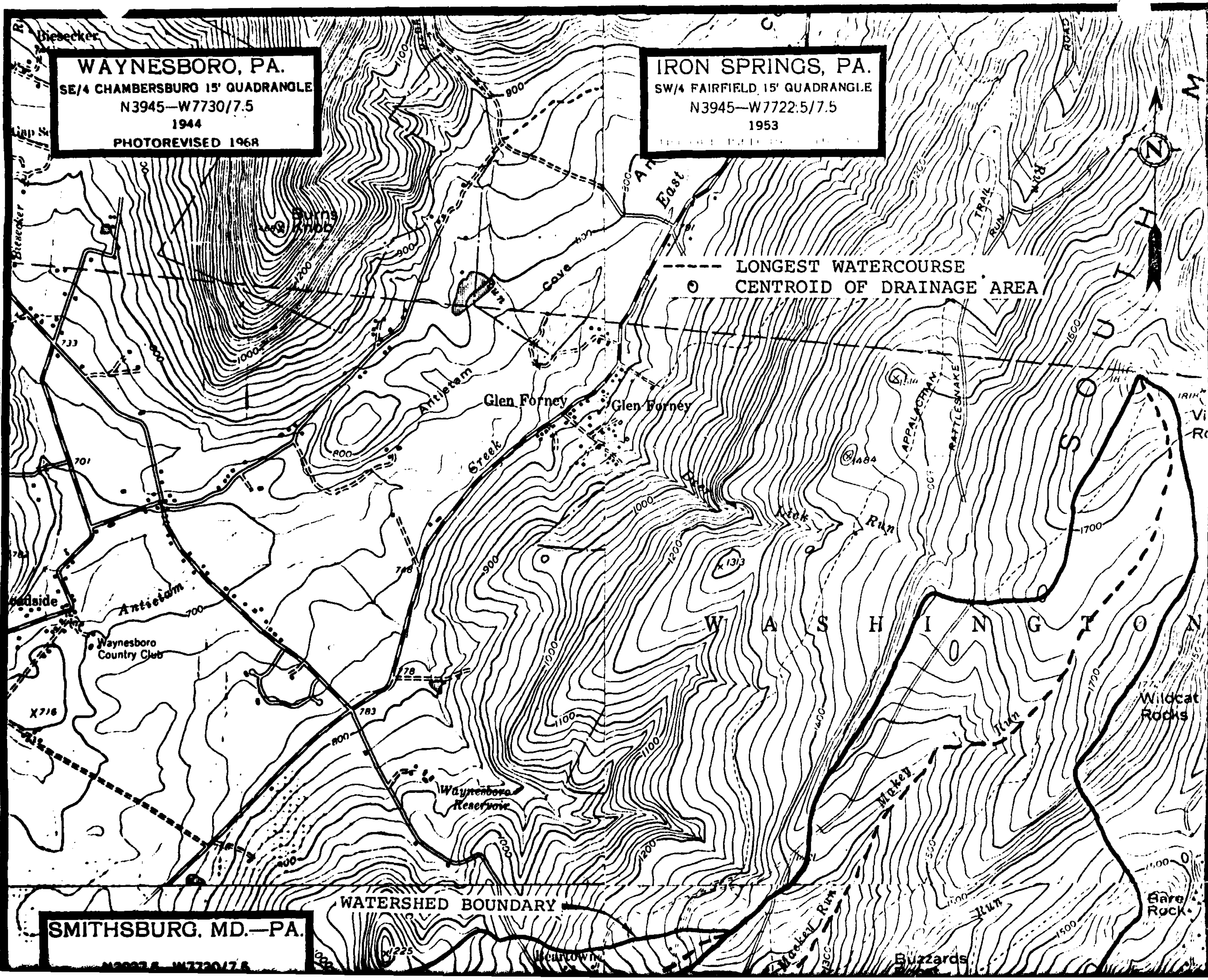
APPENDIX E

FIGURES

LIST OF FIGURES


WAYNESBORO, PA.
SE/4 CHAMBERSBURG 15' QUADRANGLE
N3945—W7730/7.5
1944
PHOTOREVISED 1968
IRON SPRINGS, PA.
SW/4 FAIRFIELD 15' QUADRANGLE
N3945—W7722.5/7.5
1953
LONGEST WATERCOURSE
CENTROID OF DRAINAGE AREA
WATERSHED BOUNDARY
SMITHSBURG, MD.—PA.
Biesecker
Burns Knob
Glen Forney
Glen Forney
Antietam
Antietam
Creek
East
Cove
Run
Waynesboro Country Club
Waynesboro Reservoir
APPALACHIAN
RATTLESNAKE
TRAIL
Run
Run
Wildcat Rocks
Bare Rock
Buzzards
Mackey Run
W A S H I N G T O N
S O U T H
M
N

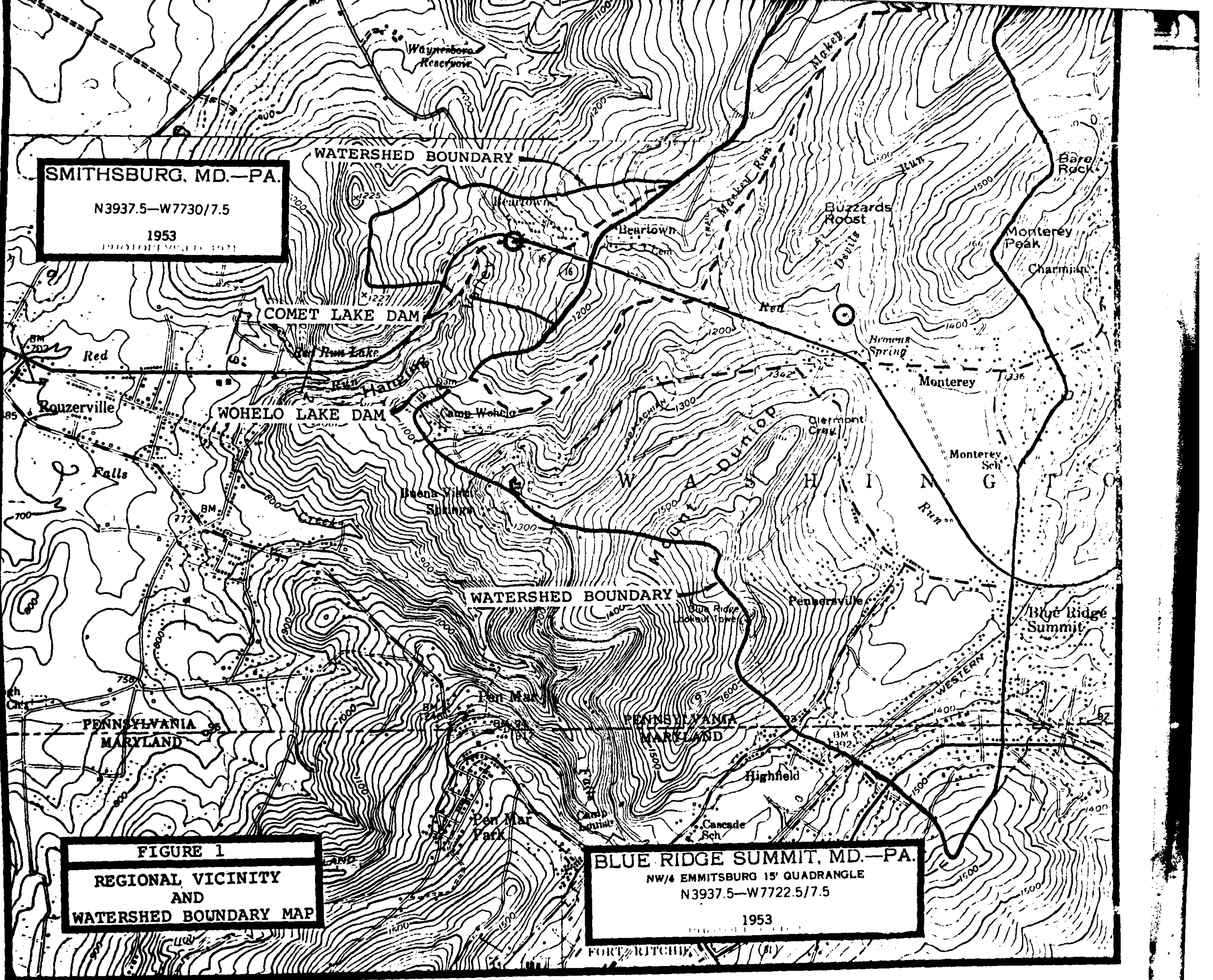
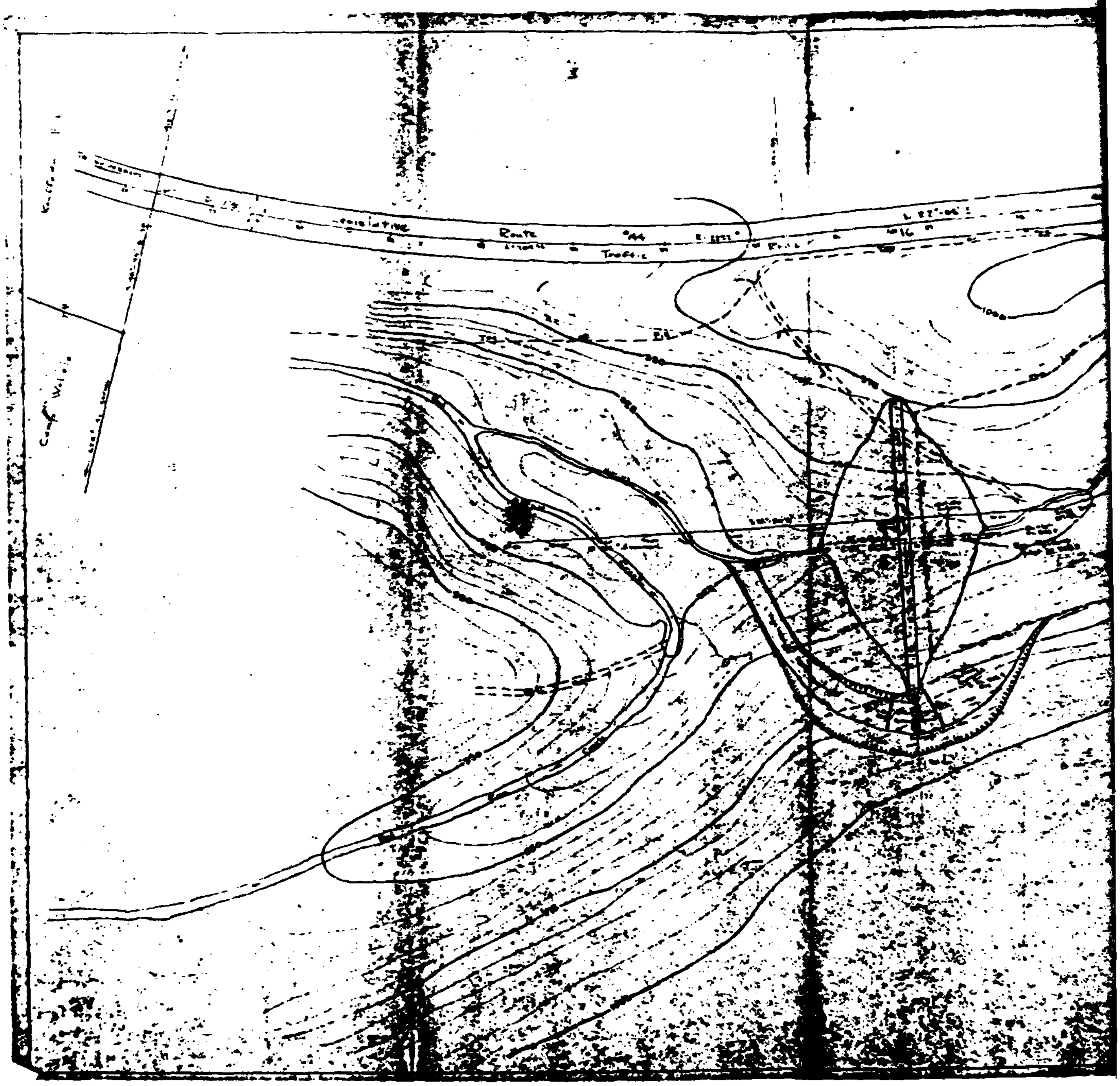


FIGURE 1
REGIONAL VICINITY
AND
WATERSHED BOUNDARY MAP



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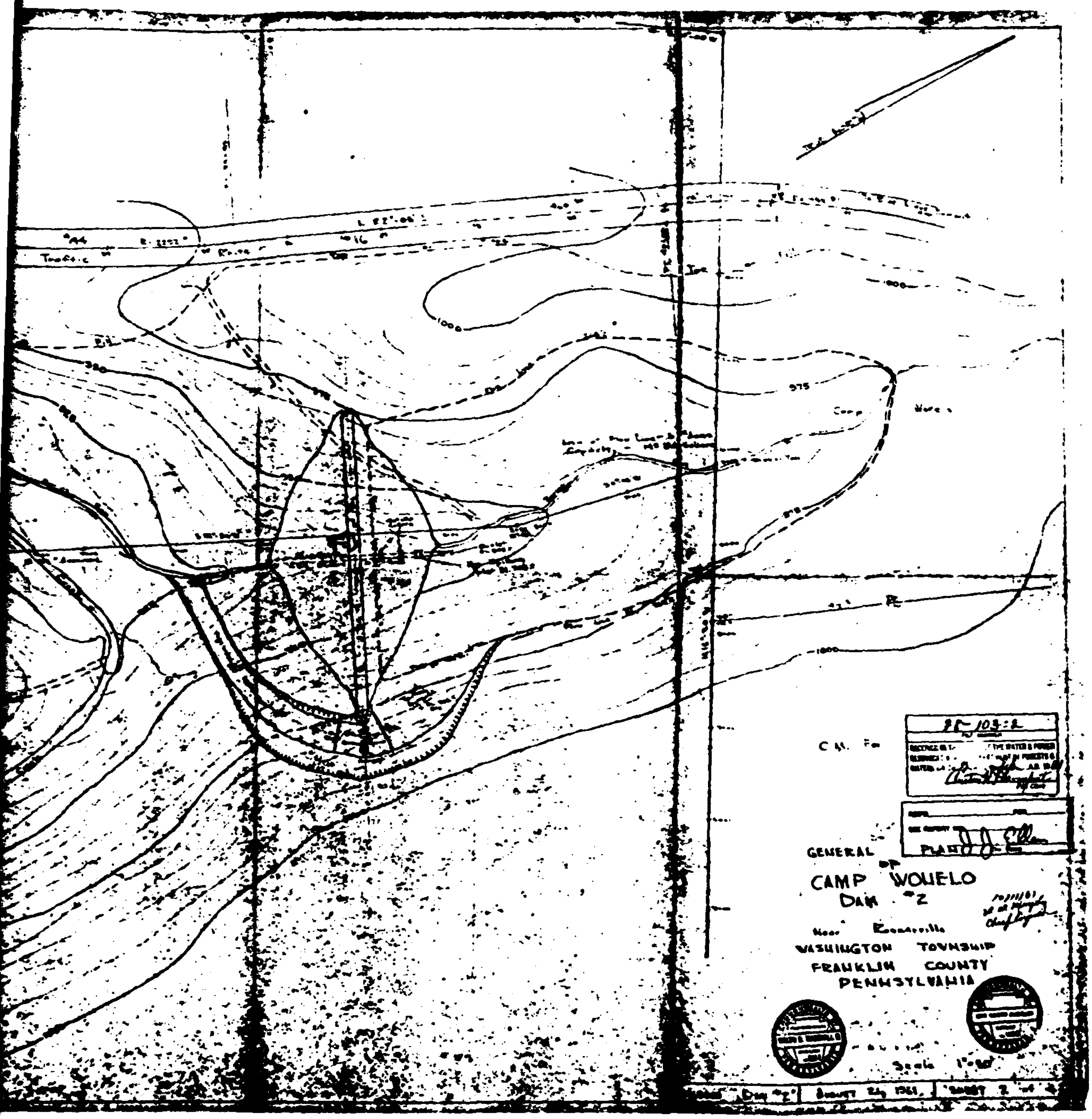

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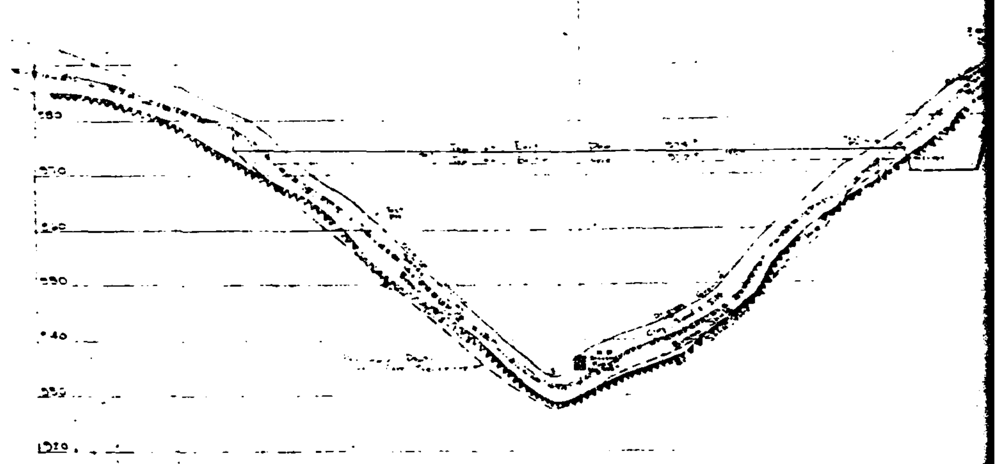
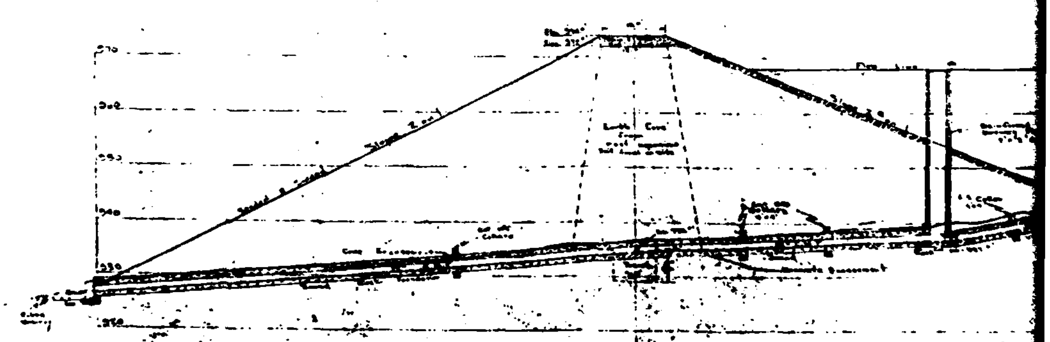
FIGURE 2



Longitudinal Section
Horizontal — 1"=30'
Vertical — 1"=10'



Cross Section
Horizontal 1"=10'
Vertical 1"=10'

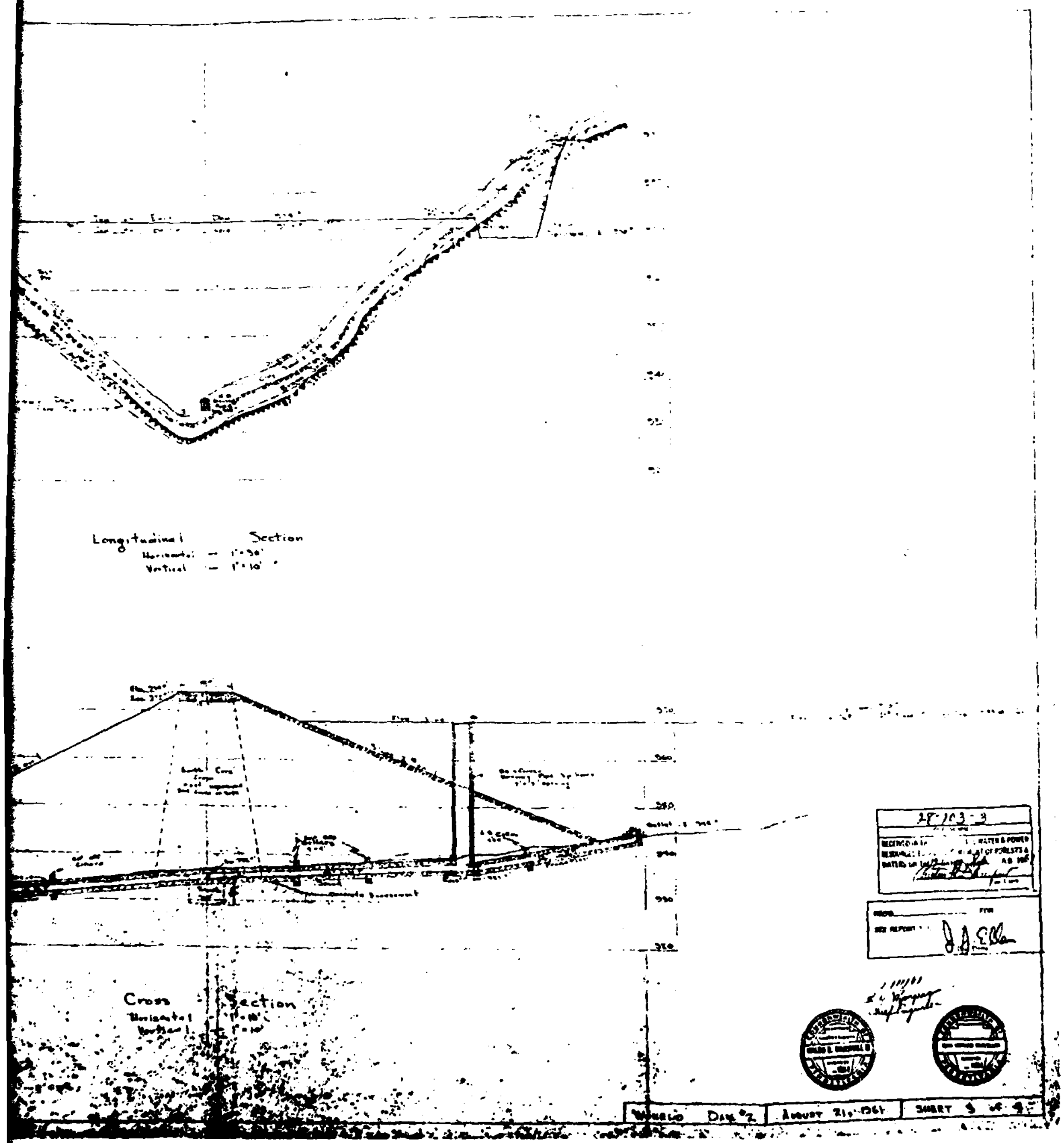


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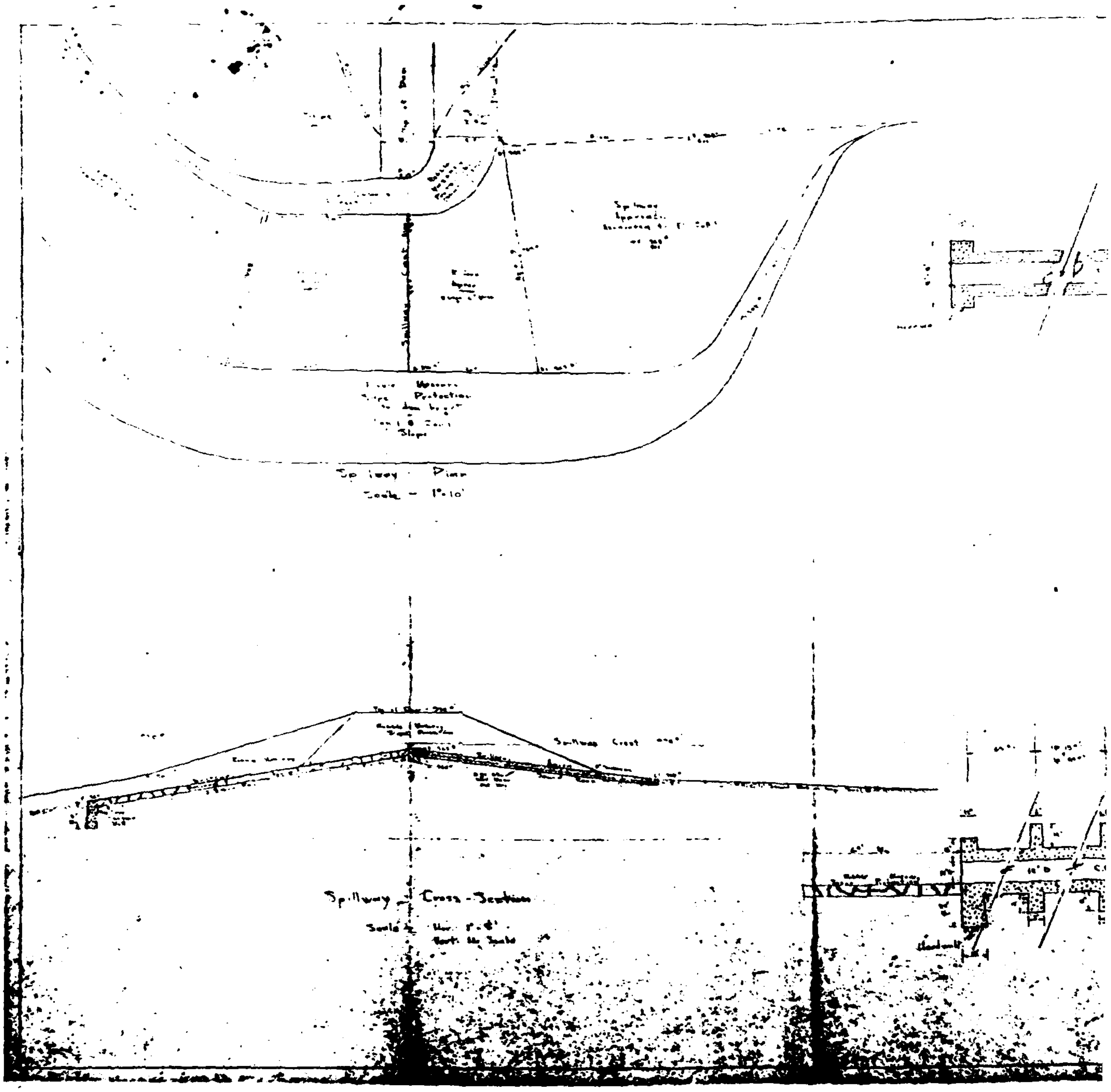
FIGURE 3


Spillway Plan
Spillway Cross-Section
Spillway Crest

AD-A091 489 GAI CONSULTANTS INC MONROEVILLE PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. COMET LAKE DAM (NDI I.D. NUMBE--ETC(U)
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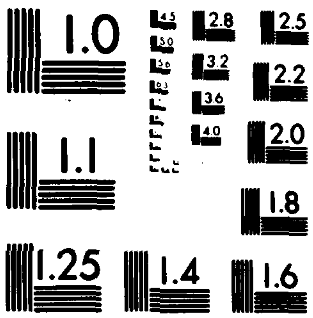

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

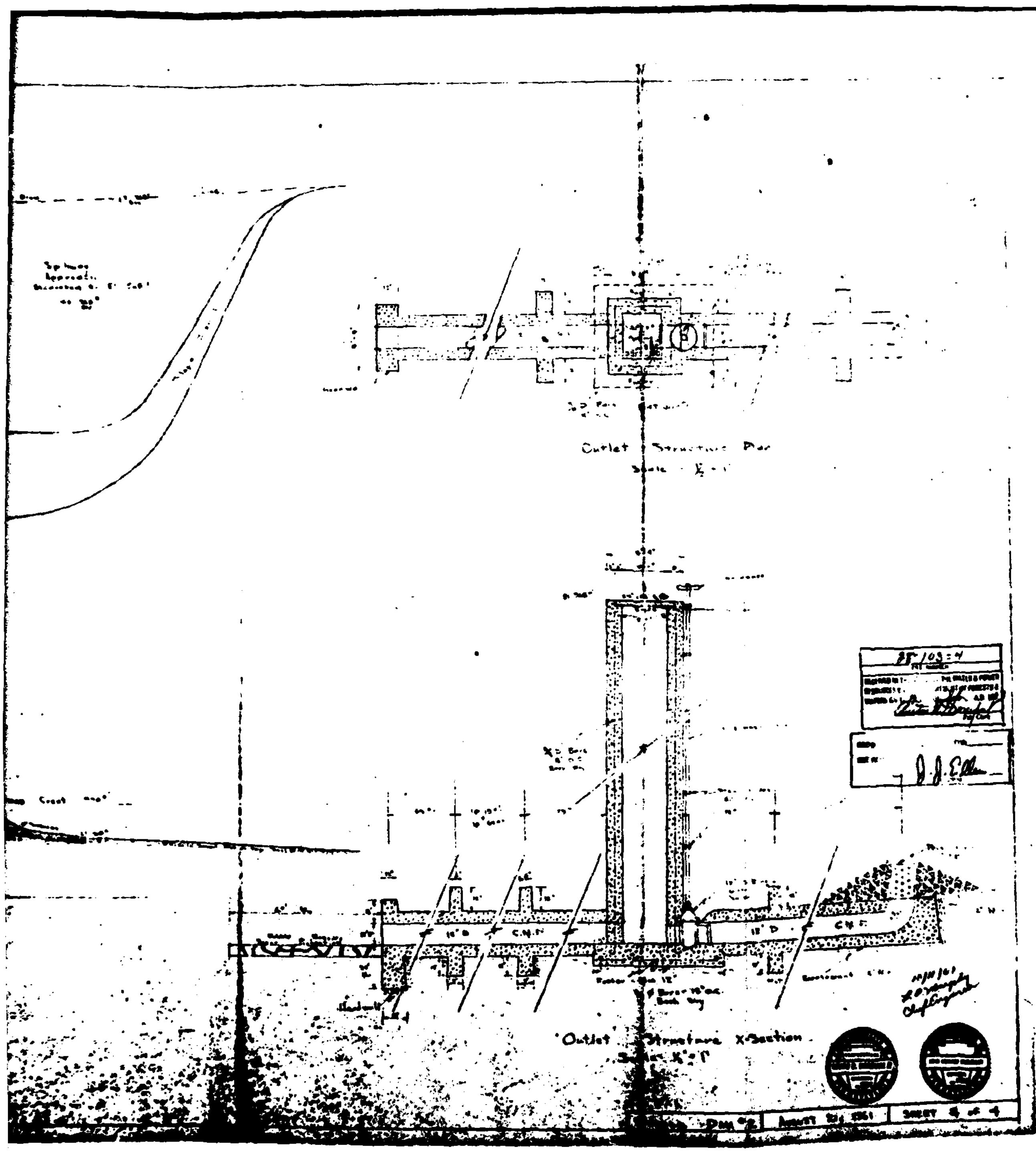

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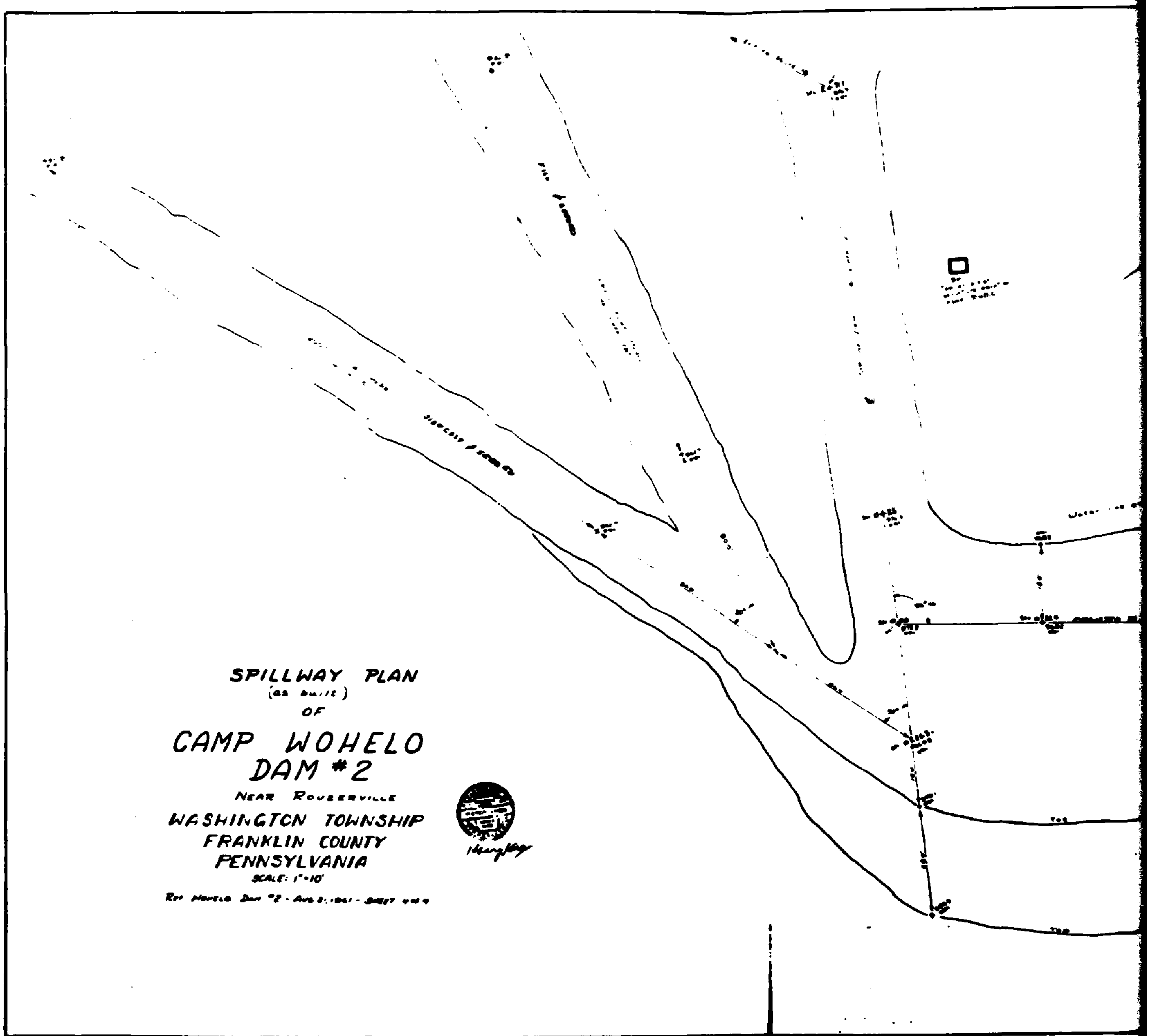
FIGURE 4


SPILLWAY PLAN
(as built)
OF
CAMP WOHELO
DAM #2
NEAR ROUZERVILLE
WASHINGTON TOWNSHIP
FRANKLIN COUNTY
PENNSYLVANIA
SCALE: 1"=10'

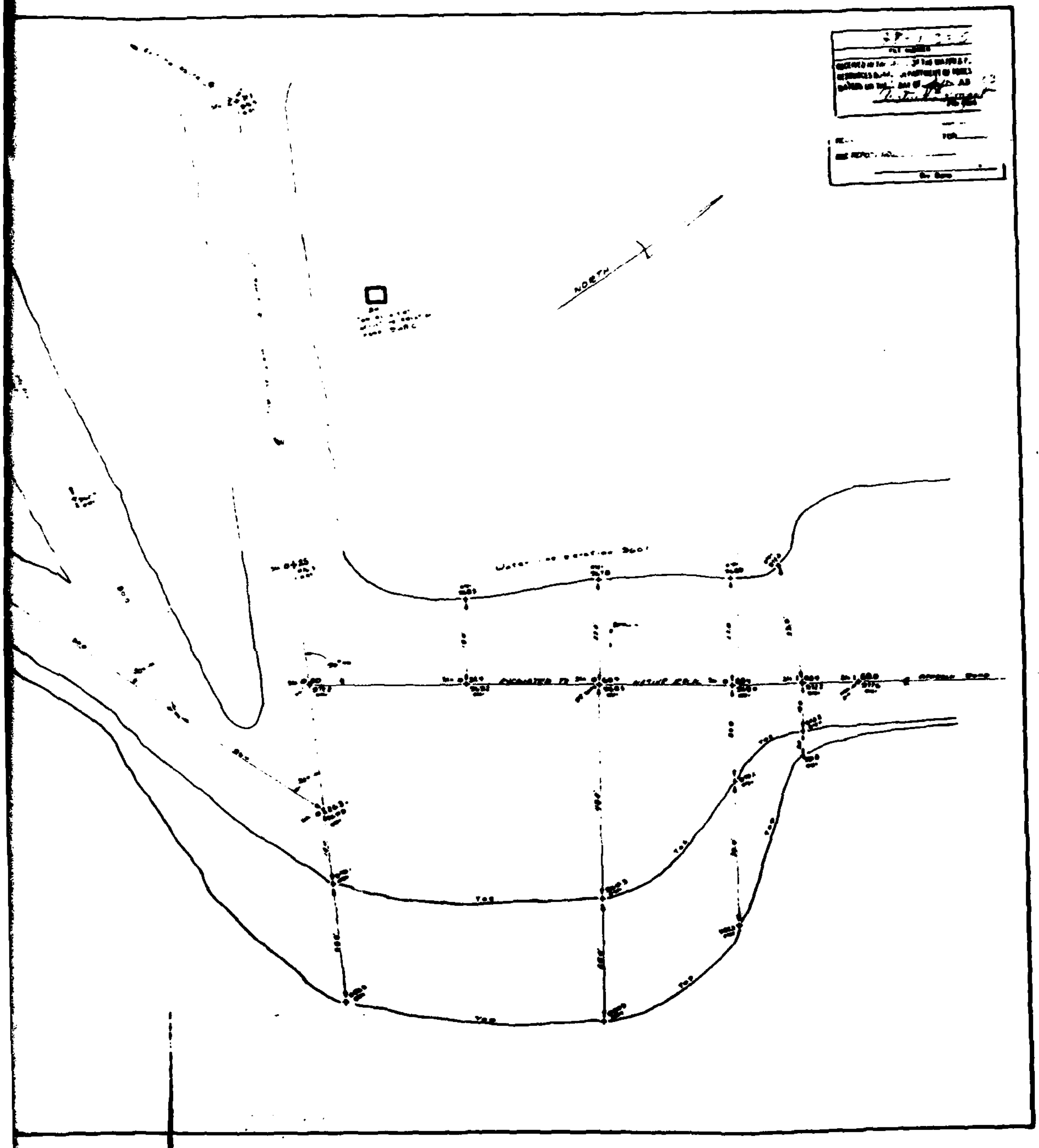


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FIGURE 5

APPENDIX F

GEOLOGY

Geology

Comet Lake Dam is located in the South Mountain section of the Blue Ridge physiographic province of southeastern Pennsylvania. This region is characterized by northeast trending ridges and valleys developed on alternating beds of volcanic and sedimentary rocks.

Bedrock immediately underlying the dam and reservoir is the Harpers Formation of Lower Cambrian age. The Harpers Formation is composed of a thick sequence of graywacke, siltstone, phyllite, and the conspicuous Montalto quartzite member. This very resistant quartzite forms the upper slopes and crests of the ridges, while the less resistant siltstones, phyllites, and graywackes underlie shallow, longitudinal valleys.

Structurally, the dam and reservoir lie on the Massanutten syncline which is bounded on the east by the Antietam Cove fault, a sub-vertical and left lateral strike-slip fault, and on the west by the South Mountain Anticlinorium. The South Mountain Anticlinorium is defined on the west by steep westerly dips toward the Cambro-Ordivician carbonates, and on the east by a series of normal faults along the margin of the Triassic basin. The immediate area contains four anticlines, in some of which the pre-Cambrian rocks are exposed, and corresponding synclines, which enclose Cambrian siltstones and some limestones.

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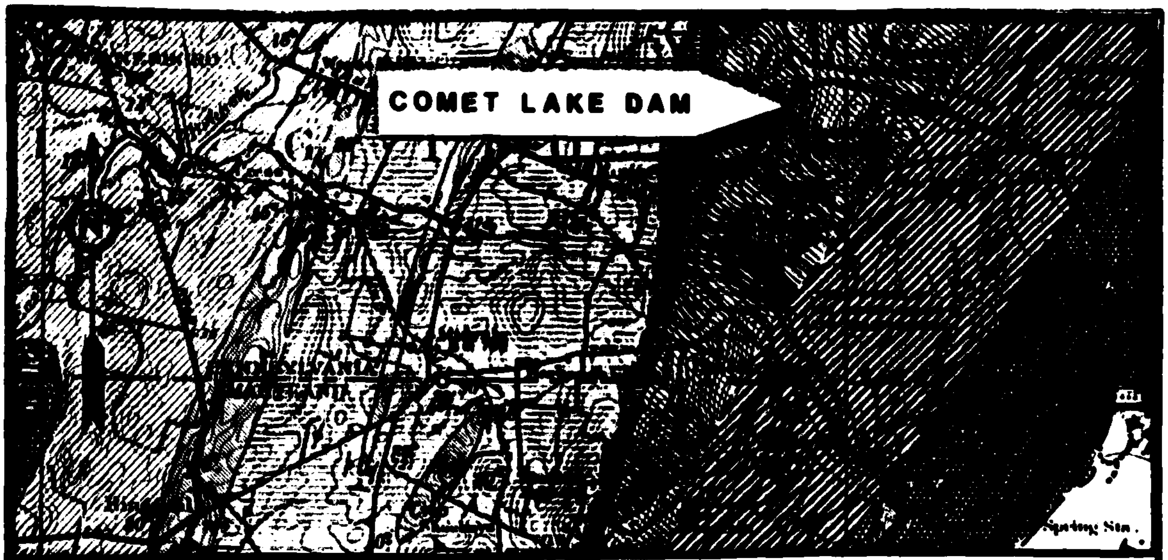

LEGEND

CAMBRIAN

Cc
Ccs
Conococheague limestone
(Hard siliceous banded limestone and calcareous sandstone with limestone pebbles. Ccs, sandstone and chert layers.)

Ce
Elbrook limestone
(Thinly laminated, fine-grained, argillaceous limestone; weathers to buff earthy limestone)

Cwb
Waynesboro formation
(Red shale and sandstone and some interbedded limestone)

Ct
Tomstown dolomite
(Chiefly dark knotty dolomite; blue-banded pure limestone in upper part, and thin intervening shale)

Ca
Antietam quartzite
(Gray to buff ferruginous quartzite; upper beds contain scanty fossil remains)

Ch
Harpers phyllite
(Gray phyllite and slate, banded with quartzose phyllite)

Weverton quartzite
(Cw, light gray to dark, purple banded, granular to vitreous quartzite and thick-bedded, purple, ferruginous quartzite; overlain by thick-bedded, hard vitreous white quartzite)

PRECAMBRIAN

Catoctin metabasalt
(Massive basaltic lava flows, composed of hornblende, albite, and epidote, with amygdular layers and secondary quartz-epidote masses; closely folded and altered to hornblende-chlorite schist in part; contains green tuffaceous schist not separated on map)

Scale

0 1 2 MILES

__REFERENCE__:
GEOLOGIC MAP OF WASHINGTON COUNTY PREPARED BY MARYLAND GEOLOGICAL SURVEY IN COOPERATION WITH U.S. GEOLOGICAL SURVEY, DATED 1941.

GEOLOGY MAP

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